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NOTES AND COMMENTS.

The Modern Scientific (?) Explorer.

THAT exhilarating zoologist, Professor A. L. Herrera of Mexico, is at it again. He has attacked the name-mongers, he has ridiculed the museums of the present, and exalted those of the future, and now he whirls his lath sword about his head and brings his jester's bauble down on the pates of "Messieurs les Explorateurs." He might have taken as his text a paragraph in to-day's paper: "The members of the British Mission to Abyssinia include a few naturalists of repute, and it is fair to surmise that whatever else the mission will accomplish, it will result in a gain to our natural history collections." Collections! why collections? Are these gentlemen not to add to our knowledge, not to make observations, not to collect facts? Alas! no. The aim of the modern explorer, as gathered from his own writings, is to amass the largest number possible of birds, butterflies, eggs, plants, fishes, etc., etc., in the hope of discovering as many new sub-species as possible to bear the name of himself, his female relations, his friends, and his native servants (*e.g. Chrysococcyx Klaasi* Le Vaillant: "ce Klaas ce pauvre et bon hottentot.") As for natural features of the earth, it is no longer necessary to discover new ones, for it is nowadays so easy to alter names given by previous explorers, to say nothing of natives, and to impose one's own from the poles to the equator.

It is not only the explorers, properly so called, with whom Professor Herrera thus gently trifles. He has a kind word for the humble collectors, "dignes confrères de leurs espèces nouvelles." How sad it must be for them that many former varieties are now common and losing their money-value! How dreadful that there should be any difficulty in obtaining new species to describe! And here is a tale to be told with bated breath: "A half-civilised Australian black-fellow presented an exploring commission with a box

of bird-skins, supposed to belong to perfectly new species, *about whose biology nothing whatever was known.* The box was sent to the British Museum, where it stayed five years and was returned, still unopened, by the worthy officials, who had not time, they said, to take up the subject. Five years after the same box was sent to the kindred establishment in Paris, and only seven or eight years had passed when the commission heard that the new species had not been described because the box was in a part of the museum where the assistants only went once in twenty-four hours, and they were not quite sure what had destroyed the skins—a mouse or a rat." Only one statement makes us doubt the truth of this tale: we cannot believe that a box which had once entered the British Museum ever left it again.

A "DUNCIAD" OF ZOOLOGY.

THEN the describers, the cataloguers, the popular natural history writers. They are all belaboured by our witty professor. Thirty-four zoologists at least have written on the non-marine molluscs of Mexico; and yet Professor Herrera challenges them to produce any information as to the bionomics of the animals. An extraordinary number of people collect birds' eggs; and the publications devoted to them, especially in America, are remarkable in number and in many respects. There are 52,510 eggs in the U.S. National Museum. Perhaps the 600 and more oölogists remember Claude Bernard's remark that no mystery is greater than that of the egg. "En effet, il n'y a pour moi [M. Herrera] aucun mystère plus obscur ni plus passionnant."

Here are some choice examples of modern zoological literature culled by Professor Herrera from well-known sources. A "Catalogue of the Birds of Dominica," contains such remarks as these: "*Dendrocea plumbea;* nothing known of it. *Setophaga ruticilla;* not common. *Coccyzus minor;* trusting and stupid; etc., etc." One eminent explorer thinks it necessary to waste printers' ink thus: "Like all pigeons, this one is fond of water." It would have been more interesting, thinks our satirist, if he had written: "Like all explorers, this pigeon is fond of whisky."

The paper ends with three model reports for explorers to follow: the first imitates the style of the poet-explorer; the second is typical of those who observe nothing; the third represents those who know nothing. We need not reproduce these quotations. Similar instances are but too familiar to all of us. They make us wonder whether this clever naturalist is not wasting time and paper quite as much as those whom he attacks. The people who can write drivel like that which he quotes cannot possibly have the humour or intelligence to appreciate Professor Herrera's sarcasm, if ever it reaches them.

"Wit shoots in vain its momentary fires.'

Menelik's Library.

The above-mentioned mission to Abyssinia might well be recommended to make enquiries into the library of Menelik. We learn from *La Naturaleza*, Madrid, that, at the time of the Mohammedan invasion of Ethiopia in the 16th century, the Abyssinians placed all their Ethiopian manuscripts in Debra-Sina, one of the islands on Lake Zonay, and here they remained carefully guarded by the inhabitants, who looked upon the books as tutelary deities. Not long ago the Negus sent an expedition to conquer these holy islands, and has built in his capital, Addis-Ababa, a library for the reception of the manuscripts thus recovered. In ancient times Ethiopia was a great centre of learning, and some of these manuscripts have doubtless extreme value.

The Shell-ornaments of the Mas d'Azil Scholars.

Our readers will remember those still more ancient manuscripts, painted on stones discovered in the cave of Mas d'Azil by Mr. Piette, an account of whose researches was given by Professor Haddon in Natural Science (vol x, p 33, January, 1897). The shells collected from the various levels in that cave have been studied by Mr. H. Fischer, son of the lamented malacologist, P. Fischer, and in *L'Anthropologie* (vol. vii, pp. 633-652) he describes and figures several, some of them ornamented by man.

With the exception of three species, *Helix nemoralis*, *H. hortensis*, and *Unio littoralis*, which appear to have been introduced as food, the *remanié* and marine species seem all to have been used for purposes of adornment, and have been perforated. The perforation has been effected sometimes rudely as though with a stone hammer, sometimes apparently by punching; at others the process has been facilitated by grinding in the first instance or filing a notch with a chipped flint, whilst fossil shells have been treated equally with the recent.

Mr. Fischer takes the successive layers and gives lists of their shelly contents; he finds the prevailing species to vary in each bed, and his results are summarised as follows:—The summit of the Pleistocene is characterised by the predominance of *Pecten*. During the succeeding reindeer period *Turritella communis*, *Littorina littoralis*, and *Littorina littorea* were abundant, the two last species indicating exchanges with the oceanic seaboard. Iu the bed with coloured pebbles were considerable numbers of *Trivia europæa* and *Cyclonassa neritea*. Finally *Dentalium tarentinum*, *Unio littoralis*, and species of *Helix* predominated in the layers of shells and of axes. The fossils, which were much appreciated during the earlier periods, seem to have been neglected during the later.

Some of the species found are now confined to the Atlantic seaboard, and unless examples were, as Mr. Fischer speculates, still living in those days in the Mediterranean, near the shores of which they have been found fossil, they must have been brought from the

more distant source, and so too he admits may some of the others, which occur on both sides of the Iberian peninsula. Thus a light is thrown on the trade-routes of these learned troglodytes.

THE ROYAL BOTANIC GARDENS.

DOUBTLESS with a view to justify its continued existence the Royal Botanic Society proposes to establish "an institute for the teaching of botany" at its gardens in Regent's Park. In support of this idea Mr. W. Martindale recently read a paper before the society and various botanists well known as teachers or scientific workers in different parts of London. This paper has been widely reported and copies have been circulated. The Botanic Gardens have, in the past, been of much service to the various institutions already engaged in the teaching of botany. Tickets of admission have been liberally granted to students on the recommendation of their teachers, and specimens have been supplied without stint. As an adjunct to existing schools of botany the gardens have served a valuable purpose, and in this direction there is no limit to further development. But we strongly deprecate the establishment of an institute with the functions indicated by Mr. Martindale, for this would only compete with and not assist the older schools. When competition began assistance would probably cease, and the gardens would end by being far less useful than at present. There are quite enough "teaching institutes" to ensure that healthy rivalry which is sufficient to bring ruin to the antiquated or badly equipped. If, as is suggested, the purses of merchants and City companies, or the zealously guarded (where science is concerned) chest of the Treasury, are to be approached, let it be to give the much needed help in cases where good work is already being done, or to assist the development of the gardens in a manner that shall be supplementary, not antagonistic, to existing effort. Botany is one of the most, perhaps the most, important of the natural sciences. Its application is the basis of agriculture, and many other 'cultures' besides, involving the prosperity of our land and its colonies. But if this is to be duly recognised the science must be popularised. We do not mean degraded or enfeebled, but made interesting to that large body of people who are glad to know something of a science but have not the time or opportunity to master its abstruser technicalities. For such popularising, a show of living illustrative specimens is one necessity, a man who knows his subject and can talk about it in a clear and simple manner is the other. The Royal Botanic Society has the former, cannot it find the latter and bring the two together before an audience in its lecture-theatre on a spring or summer Saturday afternoon? If this is not sufficient outlet for its energy let it set up a laboratory fitted with apparatus for experiments in plant-physiology, and offer the loan of it to the various teachers to whom we have

referred. These would, in many cases at any rate, be pleased to meet their classes at the Gardens and explain practically what hitherto they have taught only by means of pictures or diagrams. A research-laboratory for advanced students would be an additional advantage. Efforts in the directions we have indicated would tend to ensure the continuance of the Gardens, and thus relieve the Council from anxiety as well as benefit the public generally.

The Registration of Plants.

A Section of the Association of American Agricultural Colleges has appointed a committee to consider the question of establishing an office for the registration of plants in connection with the present Division of Pomology. "The idea," says *Science*, "is to have some one place in the United States where all plants placed upon the market can be officially registered, numbered, and a description, together with specimens of the bloom, seed, foliage, and fruit, placed on record. When it is not practicable to preserve the original, coloured casts are to be prepared, as in the case of citrons, drupaceous and pomaceous fruit, as well as vegetables. In all cases where plants are sent for registration, specimens of flowers, fruit, root, tuber or seed must accompany the application. All vegetables must be accompanied by a given amount of seed (to be determined) to be preserved for purposes of noting the duration of cultural varieties, the influence of climate during any series of years or in any locality. A further purpose of the seed shall be to grow plants for purposes of identifying the sort."

As usual, the practical people are ahead of the scientific, for it is obvious that the objects of the scheme would apply equally to systematic zoology and botany. They are: (1) to discourage the duplication of names, and the re-naming of old sorts for commercial purposes; (2) to form a national herbarium of economic plants, which shall be made up largely of type-specimens; (3) to simplify the matter of nomenclature; (4) to aid the student of varieties as well as of variation in plants under culture. The only clause that does not apply to pure science is the fifth, namely, to secure to the originator of a truly valuable variety some reward for his labour, the same as is now accorded the inventor. How many more years is it to be before we see international offices for the registration of new species of animals and plants?

The Dispersal of Seeds.

We referred a few months ago to the instructive and beautiful series of specimens, models, and drawings of insectivorous plants which had been arranged in the public gallery of the Department of Botany of the British Museum. The room has lately been enriched

with another excellent teaching exhibit, illustrating the methods of dispersal of fruits and seeds.

In many cases scattering of the seed, often over a considerable area, is ensured by the structure of, or certain mechanism in the fruit capsule itself. Elasticity of the dried walls is a common agent. Many pods for instance split suddenly, the two halves twist spirally, thereby jerking out the seeds which lay in a row on their inner surface. The capsule of the violet forms on dehiscence a three-rayed star, each ray bearing the small roundish seeds in its concave upper portion, the edges of which gradually close together and shoot out the seeds. Sir John Lubbock stated that they sometimes fall several yards from the parent plant. The *Impatiens* which has taken possession of our gardens in recent years, is an admirable instance of the success of this device. Here the strips of the lateral walls of the fruit corresponding to each carpel, are at maturity in a state of longitudinal tension. Ultimately the weak place at the base gives way, and the walls curl elastically upwards, each strip slinging its seeds out with considerable force. In the closely allied genus *Geranium* the same principle holds, the outer walls of the carpel when ripe springing backwards and upwards from the central column. In *Hura crepitans*, the sand-box or monkeys' dinner-bell, a tropical American ally of our native spurges, the woody fruit explodes with a loud report by the sudden separation of the individual carpels from the centre, and the flat seeds are shot out. Other fruits and seeds are water-borne. The wide distribution of the coco-nut palm through the islands of tropical seas is thus accounted for. The fibrous husk forms the float, and its tough leathery outer layer keeps out the sea-water. When thrown up on the beach the seed germinates, the embryo growing out through the soft round spot at the end of the hard nut-like inner wall of the fruit. The three spots, like the three longitudinal lines in the wall, are relics of the time when there were three chambers to the fruit each with its seed, instead of a single one as at present.

The *Nipa* is another palm which is distributed in the same way. It grows along muddy shores and brackish estuaries from Ceylon to New Guinea. The fruits are crowded in a large round head as big as a cannon ball; when ripe they separate and fall into the mud or water, and having a thick light fibrous coat will float and may be carried a long way by currents. In his Himalayan Journal, Sir Joseph Hooker refers to the large numbers turned over by the paddles of his steamer at the mouth of the Ganges. The seeds of a widely distributed tropical bean, *Entada scandens* are often carried by the Gulf stream, and thrown up on the Western shores of our islands and of Norway, where they will germinate. Ages ago, they were floating round the estuary of the Thames, and along our southern coast, where they are found to-day as fossils along with other estuarine organisms which go to show that their habitat in

those far-away times closely resembled that to which they are now restricted.

The most effective agent in distribution is the wind. Fruits and seeds carried along by help of wings or feathery appendages are to be seen everywhere in summer and autumn. It is a significant fact that one of the characteristics of the largest and most widely spread family of seed-plants, the Compositae, is a light hairy fruit-appendage known as the pappus, and familiar to everyone in the dandelion 'clocks.' In rare cases the whole plant packs up and travels to a new locality. The Rose of Jericho (*Anastatica Hierochuntina*) is a small annual growing in desert places from Syria to Algeria. When in flower the branches are spreading, but as the seeds ripen the leaves wither and the branches dry up and curl inwards, forming a ball in the inside of which are the seed-pods. In this condition it is soon loosened from the sandy soil and carried or rolled along by the wind, and often blown into the sea. On being wetted, the branches unbend and the pods begin to open, so that if thrown up again on the shore its seeds will germinate in a new locality.

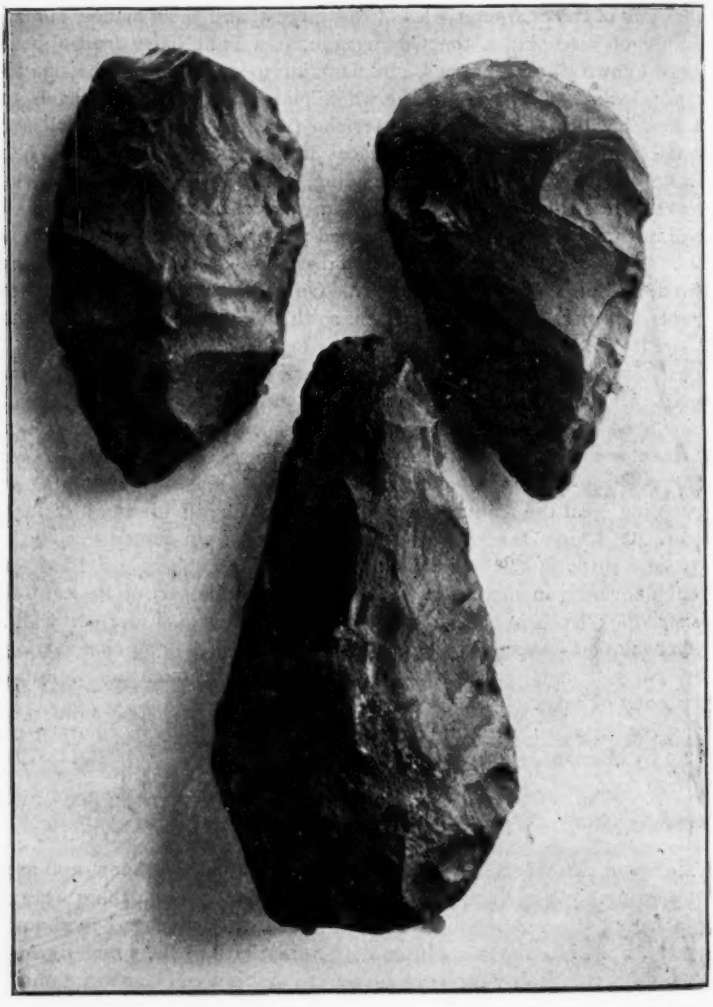
Animals also play an important part, either by carrying in their coats or feathers, or by swallowing and ultimately rejecting, the seed uninjured. For transport by the former means grappling hooks or barbed or sometimes sticky hairs are of service, to the latter we owe our brightly-coloured succulent fruits and seeds. By offering a tempting meal the plant succeeds in propagating its kind in a distant spot. Of course the seed must be protected from injury during its passage through the animal's body, and this explains its hard or tough covering in such cases. The beauty of this part of the exhibit is striking; fruits of the Yew, Guelder Rose, Rowan, Elder-berry and other familiar examples being reproduced in a modelling composition by Miss Emett with life-like brilliance of colour as well as accuracy of form.

Students can learn more by a few minutes' study of these cases than by hours of text-book reading.

The Horniman Museum.

Suburban theatres are springing up all round London, and are prospering. Why not suburban Museums? That there is an opening for them if intelligently and attractively managed is shown by Mr. F. J. Horniman's Museum at Forest Hill, S.E., which during 1896 was attended by no less than 62,119 visitors. The sixth annual *Report*, by the curator, Richard Quick, evidences a commendable activity in many directions. It has the advantage of being illustrated by some excellent photo-process engravings of objects contained in the Museum, also of a group of Burmese visitors to the Museum, showing Mr. Horniman sitting between two pretty ladies. Another plate represents three chert palæolithic implements selected from

eight in the Museum collection, which were found last March in a gravel pit near Chard Junction, in the valley of the Axe. This engraving has been kindly lent to us by Mr. Horniman. Similar implements from this neighbourhood have been known at least since 1877,



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when some from near Broom were exhibited by Sir John Evans to the British Association. The present specimens are, however, very fine ones. Fig. 1 is 8½ inches long and 4½ inches wide at the butt end; Fig. 2 measures 6½ by 4 inches, and Fig. 3, 6½ by 3⅜ inches.

The Museum appears to receive a rather miscellaneous lot of objects, but every attempt is made by Messrs. Quick and Slade to reduce them to scientific order, and make them of real use to their particular public, as well as to others in other places.

A Species-monger on New Zealand Midges.

Owing to their small size and generally inconspicuous coloration, the Diptera, or two-winged flies, usually escape the notice of the scientific explorer, unless they belong to species that display an unpleasant fondness for his blood. The Diptera of New Zealand have been more neglected than most, and Mr. P. Marshall finds that "the total number now described does not amount to more than a hundred and twenty-five species, of which only twenty belong to the Nemocera,"—the division including the midges, gnats, and daddy-long-legs. A paper by Mr. Marshall now before us (*Trans. New Zealand Institute*, 1895; pp. 216–311, pls. v.–xiv.) is a vigorous attempt to supply the deficiency. The present instalment, which is merely a beginning, deals with the Cecidomyidæ (gall-midges), Mycetophilidæ (fungus-midges) and Simulidæ (sand-flies), and includes descriptions of 62 species, 57 of which, belonging to the two former families, are introduced as new. Alas! not only are 23 of these new species described from single specimens, but many of these are females. "I have only one specimen of this insect" is a statement of irritating frequency, accompanied in more than one case by the information that the type is "rather imperfect." Nor is this all. For the fungus-midges the author finds himself constrained to make ten new genera; and of the names chosen for these, seven are already in use, in one instance in the very order which he has undertaken to study, and with a representative in New Zealand.

Those who know anything of Diptera will understand the enormity of describing a fungus-midge from a single female specimen; those who do not may be told that these little flies are but a few millimetres in length (the author, for some inscrutable reason, gives his measurements in decimals of an inch), that they are among the most delicate and fragile of their order, and that their sexual differences are often considerable. How many of these precious types will be available for comparison fifty years hence? But the author has evidently no idea of the importance and sanctity which is nowadays attached to a type-specimen. Of one insect, for which he makes a new species and a new genus (with a pre-occupied name), he writes: "Mr. Hudson has kindly lent me a specimen for drawing up this description."

Only two years before the date of his paper did Mr. Marshall begin to collect Diptera. He had meant to send them to England to have them named, but Captain Hutton advised him to work them out

himself. We cannot congratulate either entomology or the author upon the result. We have before now found it necessary to protest against the reckless coining of specific names, but never was there a case more flagrant than this. It is not even as though we were dealing with a portion of the results of a brief collecting expedition sent out from Europe. Mr. Marshall is a resident in New Zealand, and has therefore every facility for amassing an adequate amount of material before commencing author. But, two years exhaust his patience, and he proceeds to make a new species for almost every single specimen obtained. We note that he intends to publish from time to time papers on the other families of Diptera, and these he hopes "to supplement every year by species that have been discovered during the preceding year; so that, ultimately, these papers may perhaps attain to the completeness of monographs on the different families of Diptera." Monographs are not written thus. Specialists should pray that Mr. Marshall may take warning ere it is too late.

Insect Enemies of Domestic Animals.

The Entomological Division of the U.S. Department of Agriculture issues, as *Bulletin* No. 5 of its new series, a monograph of the insects which injure domestic animals. This work, containing over 300 pages, 4 plates, and 170 figures, is by Prof. Herbert Osborn. It is well up to the high level of excellence which the Washington department has taught us to expect in its publications. All the North American insects and mites which feed on the tissues or blood of man and his domestic animals are described. As many of the species are found also on this side of the Atlantic the work will be valuable to naturalists and farmers in our own countries. Though the monograph is primarily intended to instruct the practical man, and to point out methods of prevention and cure, it is well worth the attention of the biologist, who will find in it some excellent illustrations of interesting life-histories.

The Scientific Publications of the American Government.

We have often had the pleasure of alluding to similar valuable publications issued by the U.S. Department of Agriculture. We regret that this pleasure will not be ours in future, for a law has been passed forbidding the general distribution of the serial and scientific publications of the Department. Copies not required for official use will be sold by the Superintendent of Documents, Union Building, Washington, D.C. He is not allowed to sell more than one copy of any document to the same person and he will not receive cheques or postage stamps. This means that it will cost an Englishman one shilling to obtain a 5-cent pamphlet.

On the other hand, Congress has recently passed a resolution providing for the gratuitous distribution of the topographic maps and geological atlases of the U.S. Geological Survey, to the number of 500, among foreign governments and various learned bodies and institutions.

It seems, if we may venture to say so, that the whole system of distribution of these American Government publications requires reform. It is absurd on the face of it that they should be, like wisdom, "not to be purchased for gold"; while their free distribution entails enormous waste, hundreds of copies going to persons that have no need for them. Still more absurd is it that a book should lie perdu in the printing office for two or three years after it has been printed, because of some absurd official restriction. Absurd also that there should be so many editions of the same work, simply to provide the printers with what we believe they term "fat." We are therefore glad to learn from *Science* that there is a bill now before Congress calculated to effect some improvement in these matters. It will have the best wishes of all friends of American scientific men, whose earnest labour is so often dissipated by the wheels within wheels of a creaking official machine.

The U.S. Department of Agriculture.

We have recently called attention to the desire of American scientific men for greater organisation in the scientific work of the Government. An important step in this direction would undoubtedly be the appointment of a permanent director of scientific work for the Department of Agriculture. A bill for this purpose was introduced by the last Senate, and we learn from *Science* that the estimates for the next financial year recommend an appropriation of $6,000 per annum for this office. The Secretary of Agriculture under the new administration is the Hon. J. Wilson, of Iowa, who is Director of the Iowa Agricultural Station and Professor of Agriculture in the Iowa Agricultural College. It is therefore probable that his practical experience will make him a strong supporter of the above proposal.

Apropos of this Department Secretary Morton has recently called attention to the inadequacy of the salaries paid to the officials, in consequence of which the Department is constantly losing some of its ablest and best workers. "Thirty-two leading scientific experts have left the Department during the last few years to take positions in other institutions, at a rate of remuneration averaging fully 50 per cent. more than they received from the Government of the United States." Britons will find a ready parallel to this state of things in their own Natural History Museum, one of whose chief functions is to train untried youths for the service of more far-sighted institutions.

FUNAFUTI.

IN the first number of NATURAL SCIENCE an article was published discussing the proposed attempt to settle the "coral island" controversy by a deep boring into a reef. The proposal has since been carried out, and a small batch of papers gives us the preliminary results. In regard to the question which it was the main object of the expedition to solve, the result is disappointing, because it is inconclusive. The mechanical difficulties which, as pointed out in NATURAL SCIENCE, foiled the attempted borings made by the "Tuscarora," have again proved insurmountable. All students of the coral island question have long known that a coral reef is not a solid block of coral, but consists of nodular masses of coral separated by intervening patches of sand and coral debris, and sometimes even of mud. When the reefs are raised above sea level these intervening patches of loose material are soon cemented by infiltration of carbonate of lime into a fairly hard rock; but so long as the reef is below sea-level, and is saturated with water, the materials remain loose and incoherent. The Funafuti boring tool on both occasions soon reached beds of soft slime, which effectually prevented progress. These beds may be either part of a volcanic basis of the atoll, or may be only exceptionally large masses of the intra-reef sediments or beds of volcanic mud which accumulated during a period when reef-building was temporarily supended, perhaps by a too rapid sinking. So the coral island controversy stands where it stood before.

The expedition, however, has by no means been a general failure. The detailed survey of the ocean bottom around Funafuti, made by H.M.S. "Penguin," is alone of great value. Mr. Gardner has made zoological collections which have not yet been worked out, while Mr. Charles Hedley of the Australian Museum has gathered the materials for a very interesting account of the geology, botany, and ethnology of the island. This has been published as an eighty-six page paper, issued as the third of the *Memoirs of the Australian Museum*. The first batch of the zoological reports is included, but those dealing with the Invertebrata, of which a large collection was made, are not yet issued.

Mr. Hedley's account of the vegetation and ethnology of Funafuti is full of points of interest. Thus in respect to the old controversy as to the distribution of the coco-nut palm, the author opposes the view that the range of this tree is increased by ocean currents.

The natives have all abandoned paganism and are fast forgetting their ancient customs. Nevertheless Mr. Hedley was able to learn a good deal from native tales, which, however, appear to be already suffering from European influence. The Hydrographer to the Admiralty has recently published a note in *Nature*, maintaining that the soundings suggest that Funafuti and the other Ellice Atolls originated by growth on volcanic banks. Mr. Hedley on the contrary thinks that evidence on the whole supports Darwin's theory, though the grounds on which he bases this conclusion are not very substantial.

Artesian Water.

We have more than once drawn attention to the valuable work in searching for artesian water that is being carried out by the Geological Survey of Queensland. This has lately given rise to two papers (*Proc. Roy. Soc. Queensland*, vol. xii.), one by A. G. Maitland, "On the geological structure of extra-Australian Artesian Basins," which deals chiefly with those in North America. It appears from this that nowhere in that region, except perhaps at Denver, are the water-bearing rocks disposed in the shape of the textbook diagram. On the contrary, the water-carrying beds are so arranged that there is only one side of a synclinal trough, so that the strata present abundant facilities for the escape of the water, which can actually be seen to leak from them in the form of rivers.

Similar questions are dealt with in the second paper, that by R. L. Jack, "On the submarine leakage of Artesian Water." His conclusions are given as follows:—"The question at issue is no longer whether the water which, when tapped by bores, issues in artesian wells, occurs in porous strata lying underneath impermeable strata. The bores themselves have settled that, and the outcrops of the strata have been to some extent mapped, and found at altitudes sufficient to give a 'head' capable of forcing the water to the surface in the lowlands of the West. These outcrops, moreover, have been detected in the act of absorbing, year by year, more than water enough to supply the wells and springs. The question is, whether the strata form a sealed basin, or crop out beneath the ocean in such a manner as to give rise to a circulation of the underground water. A mass of evidence has been accumulated to prove that, as the strata are periodically filled up with water, they must first have lost a certain amount by leakage. In the case of Australia the only possible escape is beneath the ocean, and although we cannot observe this leakage with the bodily eye, we may believe in it, as we believe in many things we cannot see. A powerful confirmation of this view is supplied by the fact that some important artesian basins elsewhere leak out on land, while the rest have the physical conditions which must inevitably lead to submarine leakage."

Differentiation in Rock-magmas.

In the January number of the *American Journal of Science*, Dr. G. F. Becker, under the title "Some Queries on Rock Differentiation," makes a weighty attack upon certain hypotheses which have been advanced by petrologists to account for the apparent derivation of different rock-types from a common source. He approaches the subject from the physical side, and considers in turn the two distinct suggestions of diffusion in a magma owing to differences of temperature, etc., and the separation by cooling of parts of a magma which are miscible only above a certain critical temperature.

As regards the first point, Dr. Becker gives reason for believing that no appreciable effects could be produced by diffusion during any time which can reasonably be postulated. This would be true even in aqueous solutions of salts; in natural rock-magmas viscosity would further check diffusion, while convection-currents and disturbance by mechanical means would speedily undo its work. He considers that viscosity and other causes would also prevent the separation of immiscible fluids into distinct bodies occupying different spaces. As no considerable superheating will be possible in subterranean magmas in contact with solid rocks, the range of temperature must further be very limited.

Without attempting to meet the author's arguments, we may remark that the two hypothetical processes which he examines do not, as he seems to assume, exhaust the possibilities. For instance, he passes over the effects which may be expected to accompany crystallization in a slowly cooling body of rock-magma. It can scarcely be doubted that such crystallization is accompanied by a very considerable evolution of heat. Hence we should expect that, when crystallization has begun in the coolest portion of the magma, the tendency to degradation of energy will determine a movement of the constituent about to crystallize to that place, so as to maintain saturation there.

Nor must we lose sight of the possibility that mechanical forces operating during the progress of crystallization may be an important factor in differentiation. Dr. Becker ascribes the diversity of igneous rocks to original heterogeneity in the composition of the globe, and instances the fact that the eruptive rocks west of the Rocky Mountains exhibit certain peculiarities as a group. The remarkable difference, however, between the igneous rocks of the Atlantic and Pacific slopes of America seems to point not to any primitive difference between those regions of the earth's crust, but rather to the operation of great mountain-building forces, *viz.*, those which produced the mountain-axis which so sharply divides the two regions. How such forces may act as promoting differentiation is doubtless a complicated problem, but one way is very clearly indicated by such researches as those of Mr. Barrow on the igneous gneisses and pegmatites of the south-eastern Highlands of Scotland.

MODERN CRYSTAL-GAZING.

CRYSTALLOGRAPHY is scarcely a popular science; but that it can be made both interesting and intelligible, even to a Royal Institution audience, was admirably shown by Professor Miers' three afternoon lectures entitled "Some Secrets of Crystals." The first lecture opened with a contrast between the superstitions current in early times respecting the origin and medicinal virtues of crystals—superstitions which indeed still partly survive amongst the quasi-scientific,—and

the exact knowledge of crystalline substances which has been gradually and laboriously acquired during the last hundred years. The methods by which crystals grow, their shape and symmetry, and the occurrence of twinning were clearly expounded with the aid of numerous appropriate specimens and of a very beautiful collection of lantern slides. The second lecture was devoted to an able exposition of multitudinous experimental methods which have been applied by crystallographers to the determination of crystalline symmetry; an opportunity was thus afforded for exhibiting a number of pieces of exact crystallographic measuring apparatus which are unfortunately too seldom seen and even less frequently used in this country. The last lecture dealt mainly with the structure of crystals. This subject, which has only been brought to its present satisfactory state during the last few years by the labours of Fedorov and Barlow, is of so complex a nature as to excite no little wonder at the lecturer's temerity in attempting to present even its barest outlines to a lay audience; the discourse, however, left little to be desired in point of lucidity and may possibly be of permanent value in destroying some part of the reputation for profundity hitherto enjoyed by the theory of crystal structure. A brief description of a few of the more important applications of crystallography concluded the course.

The most vivid impression left by these lectures is that the crystallography of to-day with all its far-reaching ramifications constitutes a science founded upon a secure mathematical basis, and so securely founded as to rank in this respect beside the better-known exact physical sciences. This being the case, it is difficult to understand why a subject of such wide application—which bears so minutely upon the most remote problems of physics and chemistry and which could be so advantageously used as a teaching tool in connection with the geometry of space, spherical trigonometry and many branches of physics and chemistry—does not more frequently find a place in the courses of instruction given at our higher schools and colleges.

North American Oligochaetes.

Mr. F. Smith has lately been studying the terrestrial and aquatic Oligochaeta of North America with some success. We have before us (*Bull. Illinois State Lab.*, vol. iv.) the second of his articles on the subject, which includes descriptions of a new Lumbriculid from Illinois and of a new species of *Microscolex* from Florida. The first-named worm is referred to a new genus *Mesoporodrilus*, which is of some interest. The most remarkable fact about it is the unilateral development of the male efferent apparatus, which opens in the middle ventral line. It seems to be much like that of *Eclipidrilus* and *Sutroa*, in that the atrium is surrounded by the sperm-sac. The spermathecae are two, lying in successive segments, and each opening also on to the middle line. The number of new forms from the North American

continent described by Mr. Smith and by Gustav Eisen tends to prove the distinctness of the Nearctic region so far as concerns these animals, though this was doubted (previously, however, to much that has been made known lately by these two observers) by Beddard in his Monograph of the Oligochaeta.

The Literary and Philosophical Society of Newcastle-on-Tyne.

In 1793 this society began its existence, and quite recently Dr. Robert Spence Watson has published its "History" from 1793 to 1896. The foundation of this venerable Society was due to the Rev. William Turner, an Unitarian minister, who was one of a circle of friends who met together for conversation and debate. Mr. Turner was asked to draw up a scheme for a permanent Institution and read a paper in the winter of 1792, called "Speculations on a Literary Society." This created no small interest, and a meeting was held on January 24, 1793, to further consider the subject. A committee was formed and at a second meeting on February 7, the proposal took definite shape, and the "Literary and Philosophical Society of Newcastle-on-Tyne" was founded. In the early days of the Society Mr. Turner was the most prominent member, lecturing for 30 years on all branches of science. He delivered the address on the occasion of the opening of the present buildings in 1822, and finally resigned his official connection with the Society in 1833. It is a noteworthy fact that many of the discussions and papers dealt with important local economics, such as:—the embankment of Jarrow Slake; the improvement of the river Tyne; new quays; deepening of the tide-way; chemical and manufacturing subjects; and agriculture. No less than 3,000 lectures have been arranged by the Society since its inauguration, and the value of the work done by it from an educational point of view is incalculable.

In 1793 a library was established and despite a disastrous fire in 1893, has now grown to be of considerable value. A museum was founded about the same time, and has grown into the collection now housed at Barras Bridge. Among the long list of bodies that have owed their origin to this parent society, we may refer to "The Natural History Society of the Counties of Northumberland, Durham, and Newcastle-on-Tyne," "The North of England Institute of Mining Engineers," and "The Farmer's Club for Newcastle." It also in 1806 practically founded the Royal Jubilee School, which provided free teaching for the poor of Newcastle. Dr. Watson has done well to record the history of a Society which has done so much to advance the education and interests of so important a centre.

I.

On the Discovery of Chipped Flint-flakes in the Pliocene of Burma.

IN the *Records* of the Geological Survey of India for 1894 (vol. xxvii., pp. 101–103), I published an account of the discovery of some curiously shaped flint-flakes which were found together with vertebrate remains of the Sewalik type, and in particularly close association with a molar of *Hippotherium antelopinum*. A review of my paper, with figures of the principal flake (here reproduced in Fig. 1), was contributed by Professor T. Rupert Jones to NATURAL SCIENCE (vol. v., pp. 345–349, November, 1894). I did not express any definite opinion as to the origin of these remarkably shaped flakes, although I thought it rather difficult to imagine any natural process by which flakes of such a shape could be produced. I was well aware that the heating of flints by the sun and their rapidly cooling down during the night might result in the production of splintery fragments, as had been actually observed by various travellers in deserts, and described by O. Fraas in "Aus dem Orient" (pp. 38, 39). The dry climate of Central Burma, particularly the country around Yenangyoung, with its rapid changes of temperature, ranging from about 52° to 100° in December or the beginning of January, would be well adapted for the disintegration of exposed flints, and if I had found the specimens lying loose on the surface of the rock, I would certainly have attributed their shape to the influence of temperature. As it was, the original specimens were not found lying loose on the ground, but were imbedded in the matrix of a conglomerate, which in a subsequent paper[1] was referred to as the zone of *Hippotherium antelopinum* and *Acerotherium perimense*. In other words the flakes were *in situ* when found.

As I have personally no large experience with regard to stone implements, I left it to authorities in that matter to decide whether the specimens I discovered were of an artificial nature or not. I claim, however, enough experience to be able to say whether a particular fossil was or was not *in situ* when found. So far, nobody seems to have doubted the story of the find as given in my first paper.

[1] *Records Geol. Surv. India.*, vol. xxviii., p. 84, 1895.

To me it seemed perfectly clear when I expressed myself as follows: "One of the most conspicuous beds, palæontologically as well as petrographically, is a ferruginous conglomerate, upwards of 10 feet in thickness. This bed may be distinguished a long distance off as a dull-red band, running, in a continuous line, across ravines and hills. Besides numerous other vertebrate remains, such as *Rhinoceros perimense*, etc., one of the commonest species is *Hippotherium antelopinum* Caut and Falc. of which numerous isolated teeth can be found. *While stooping to pick up the fine lower molar, which is figured in the accompanying plate, my attention was drawn to some curiously shaped flints partly imbedded in the ferruginous conglomerate.*" (Italics not in original.)

Originally I believed this bed to be Miocene. Subsequent examinations, however, have proved that Dr. Blanford's doubts as to the age were well founded, and that it must be considered as Pliocene. It would lead too far if I were to give here the proofs for this view, and for details I must refer the readerto my Memoir on the petroleum-

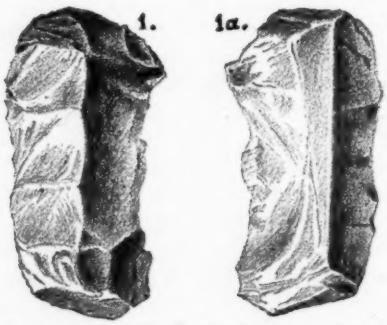

FIG. 1.—FLINT-FLAKE FOUND *in situ* IN LOWER PLIOCENE, BURMA.

field of Yenangyoung, which has unfortunately been greatly delayed in publication, but which I trust will soon be before the public.

In March, 1893, while I was still engaged in the examination of the country around Yenangyoung, Mr. R. Oldham visited me at that place, and desired, amongst other subjects of interest to him, to see the locality where the flakes were found. I pointed out the exact locality, where we spent at the outside a quarter of an hour, without however finding any other flakes; nor did we find any fossil bones or teeth, I might say as a matter of course, as I had repeatedly so well searched the place myself that not a single specimen could have been left unnoticed. We then proceeded further south; I showed Mr. Oldham the locality where countless specimens of *Batissa* (*Cyrena*) *petrolei* and *Batissa* (*Cyrena*) *crawfurdi* occurred in pockets at the base of the ferruginous conglomerate. At another locality we found fragments of fossil bones. Eventually we came at the extreme end of the Yenangyoung dome, near a hill called Minlin (on the maps it is

usually called Minlintoung, "toung" being Burmese for "hill") to a place where the ferruginous conglomerate rises to the surface, in other words forms part of the beds that crop out on the plateau. For details I must again refer the reader to my Memoir on the Yenangyoung petroleum-field, as it is impossible to explain the rather complicated stratigraphy without a map and numerous sections, and in the meantime the above statement must be taken on trust. At this locality I had previously found some similar, but not so well shaped flints, which I had, however, disregarded for the following reasons:

1. The specimens were lying loose, and I was not so absolutely sure that they were *in situ* when discovered, as I was with those first mentioned.

2. Being on the plateau, I admitted the possibility of an ancient settlement at this locality.

As both these exceptions might be raised, I thought it more prudent to disregard for the moment the second locality until I had learnt the views expressed by authorities in such matters about the nature of the flakes described in my first paper, as to the position of which I was perfectly sure. If these specimens were not regarded as artificial, it was useless to mention their occurrence at a second locality, but if they were thought to be artificial, there was plenty of opportunity to mention and describe this second occurrence, particularly as I found at a third locality a remarkably polished femur of which I shall have presently to say more. Mention of this femur was withheld, as I wanted to ponder the matter before expressing an opinion.

To my great surprise, Mr. Oldham has in NATURAL SCIENCE for September, 1895, (vol. vii. pp. 201 and 202) given an account of the occurrence of the flakes, so incorrectly stating the facts that a reply and restatement of them appears necessary. I have unfortunately partly been detained by more pressing work from replying at an earlier date; partly I wished to wait for the publication of my Memoir on the Yenangyoung oilfield, because I am now, while on furlough, obliged to write from memory. If therefore some of the figures given below do not quite correspond with those in my Memoir I must ask the reader to excuse these discrepancies in minor matters; but the chief facts will be found to be correct.

I think it best to give first a short description of the country around Yenangyoung, as it is of some importance with regard to the objections raised by Mr. Oldham.

The town of Yenangyoung, famous from the oldest ages of Burmese history for its petroleum wells, is situated on the left bank of the Irrawaddi in Lat. 20° 21′ N. and Long. 94° 56′ E. The country on this side of the river is for miles and miles a barren and almost desert low plateau about 100 to 150 feet above the level of the river, rising gently inland, *i.e.*, towards the East. Seen from a distance

the country appears a continuous uninterrupted plateau, studded with a low thorny jungle, but on closer examination it is found to be intersected by countless tortuous ravines and gullies which offer considerable difficulty to anyone traversing the country. Owing to the soft nature of the Tertiary rocks the ravines are generally rather narrow, and the slopes steep, but to the geologist they afford in their barrenness delightful opportunities for the study of the strata. For the greater part of the year the ravines are perfectly dry, and if water is found at some depth it is always brackish and extremely unwholesome. The ridges left between the ravines vary of course in extent, owing chiefly to the nature of the rocks which crop out on the surface, but whether narrow or broad, not a drop of water is to be found on any one of them unless it be collected in artificial tanks. There is hardly any humus, and it may be doubted whether any crop worth speaking of could be grown. Everywhere lumps, sometimes even large logs, of fossilised wood may be found scattered all over the ground. Where a conglomerate crops out, it may be followed often for a long distance by a more or less broad band of white quartz pebbles. Patches of diluvial river-gravel resting unconformably on the Tertiary rocks may be seen here and there, topping the ridges. It is important to note that it is often extremely difficult to decide, when only a thin coating of scattered pebbles covers the ground, whether it represents a disintegrated bed of Tertiary age or the last remains of the diluvial gravel that has escaped being washed away. As the chief constituent of both, white quartzite, is the same, and as it is difficult to say whether the fragments of fossilised wood, scattered among the pebbles, come directly from the underlying Tertiary beds, or were already contained in the diluvial gravel, no definite distinguishing feature has hitherto been found. It is true that in the diluvial gravel the fragments of fossilised wood are generally well rolled, but it is not easy to distinguish them when lying scattered on the ground.

From the above remarks it will be seen why I have not mentioned the second locality near Minlintoung. The conglomerate comes here up to the surface; its outcrop is marked by a band of white pebbles, amongst which I found some fine fossil teeth and the flints. Although I myself did not doubt for a moment that both had been derived from the disintegration of the solid rock beneath, I left it open to doubt, at least with regard to the flint-flakes (the teeth belonged unquestionably to Pliocene animals) whether they might not have been transported from some other locality to the place where I found them, and which I pointed out to Mr. Oldham. I confess, however, that not for a moment did I think that Mr. Oldham would so entirely misunderstand this fact as to say, "the implements are not confined to the outcrop of the fossiliferous ferruginous bed, but are scattered over the surface of the plateau above." It is a mistake to say that the implements are scattered over the surface of the plateau;

when found on the plateau, as near Minlintoung, they are strictly confined to the outcrop of the ferruginous conglomerate.

From the foregoing it will be clear why I did not mention the second locality in my first paper, although personally fully convinced that the flakes were derived from the conglomerate underneath, just as much as the fossil bones.

The view that an ancient settlement may have existed at this spot can be discarded at once. Even if we admit that there was room enough for it, what did the people live upon, and what is still more important, where did they get their water from? There is no spring on the rocks for miles around; in the ravines the water, when present at all, is always undrinkable; the water must therefore have been carried from the river for several miles, and I greatly doubt whether the ancient makers of the implements preferred to carry their drinking water over several miles of rugged country, when they could have it much more easily by settling on the river bank.

The strata which are found around Yenangyoung are limited to the Tertiary and Diluvial formation, the latter resting unconformably on the tilted beds of the former.

The Tertiary beds are represented by the younger Tertiary only, the Nummulitic Formation being entirely absent, or at least not coming to the surface. The oldest beds belong to the Miocene, but although they have been proved by deep borings to be of considerable thickness they crop out only over a small area. The beds belong in small part to the Prome stage, and in larger part to the Yenangyoung stage, terminating in the *Batissa (Cyrena)* bed, as explained in vol. xxviii. of the *Records* of the Geological Survey of India (pp. 64, *et seq.*, 1895).

Of the youngest Tertiary, the Pliocene or Irrawaddi Division, not less than 4620 feet is exposed, although probably this does not represent nearly the whole thickness. It consists of a series of soft yellow sandstones, alternating with beds of clay, conglomerates, and bands of very hard siliceous concretions of nodular shape. Single beds do not continue for any distance; they frequently die out, and are at the same horizontal level replaced by others of a different nature. Numerous instances will be found in my Memoir on the Yenangyoung petroleum-field. It is therefore hopeless to attempt any general sub-division from a lithological point of view, and any, chiefly based on lithological differences, must be considered as merely local.

The conglomerates are frequently only pockets or patches within the sandy beds, but sometimes they may be several miles in length, and as they usually contain numerous remains of Vertebrata, they are of the greatest importance for the study of the Irrawaddi division. For this reason I devoted special attention to their examination wherever I found such a bed, and mostly my researches have been rewarded, although the fossils seem to occur in rather an erratic

manner. I remember an instance near the bank of the river, where a bed of conglomerate was fully exposed, measuring about 30 feet in length, 15 feet in height, and four feet in thickness. In this I found a splendidly preserved incisor of *Hippopotamus irravadicus*, but not a single other specimen. It must further be mentioned that these conglomerates vary greatly in hardness; sometimes they are hard and siliceous, ringing under the hammer when struck; sometimes they are loose masses of concretions of hydroxide of iron, formerly used by the natives for smelting; sometimes they are soft and earthy; in fact their physical appearance varies greatly. Some of the smaller beds are exactly like a shingle beach on the sea-shore: more or less rolled clay pebbles, small pieces of wood, and fragments of bone, hardened by a ferruginous solution. Small beds of this kind may extend only for a few feet, but they generally contain an interesting fossil. It was in one of these small layers that I found the polished bone of which I shall presently speak.

At Yenangyoung the Yenangyoung stage begins with a very conspicuous band of ferruginous conglomerate, which from its persistency forms a very good horizon so far as this part of the country is concerned. Its thickness as well as its hardness varies greatly, but the former never exceeds 20 feet. It is followed by soft yellowish sandstone, which at some places immediately above the main bed contains some smaller conglomerate beds. Fossils are, as already stated, frequent but erratic.

The strata form an anticline, the axis of which runs N.N.W.–S.S.E., dipping at about 30° to 32° towards S.W. and N.E. At the same time the axis drops from a point, which is marked by the oil-field of Twingon (northern part of the Yenangyoung oilfield), in a northern as well as in a southern direction, so that it is quite obvious that the strata form here a kind of dome, the highest point of which would be about 6,000–7,000 feet above sea-level, if there had not been any denudation. It will be seen from this that the line of outcrop of any given bed must form a closed circle, which, in fact, is represented by a rather irregular ellipse, stretched in the direction of the strike. This remarkable structure was first revealed by the careful mapping of the run of the ferruginous conglomerate at the base of the Irrawaddi division. The tilted-up strata were eventually planed down to their present level, forming a low plateau, gently rising from west to east, which has now been cut into by numerous watercourses.

From the above description of the stratification it is quite clear that a given bed, which dips East and West respectively on each side of the dome, and which does not come up to the surface of the general plateau, may form part of the surface at the northern and southern end of the dome. It is at such a point, where the ferruginous conglomerate, *(Zone of Hippotherium antelopinum and Acerotherium perimense)* comes to the surface, although it nowhere else forms part

of the strata actually cropping out at pleateau level, that the chipped flints were found; and it is from this that Mr. Oldham imagines them to be scattered over the plateau.

I mentioned above that the conglomerates generally contained vertebrate remains, and in collecting such I examined their outcrop very carefully. The extended bed at the base of the Irrawaddi Division afforded special opportunities, owing to the length of its outcrop, and while thus searching for fossils I discovered the flint-flakes.

It will, however, be useful to describe the locality where the find was made, as exactly as is possible without reference to the map. On the eastern side of the Yenangyoung dome the ferruginous conglomerate runs for a considerable distance along the eastern slope of a gully which has a north-and-south direction, and which, by a low ridge, is divided into two sections, one draining northwards and the other southwards. As is usual in this part of the country, the ravines very quickly attain a considerable depth, the slopes becoming very steep, so that they are often impracticable. While following the

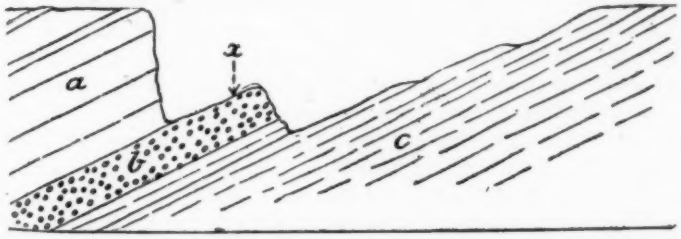

FIG. 2.—DIAGRAMMATIC SECTION ACROSS THE RAVINE IN WHICH, AT *x*, THE MOLAR of HIPPOTHERIUM ANTELOPINUM AND THE CHIPPED FLINTS WERE FOUND.

(*a*). PLIOCENE. Zone of *Mastodon latidens* and *Hippopotamus irravadicus*.

(*b*). PLIOCENE, Zone of *Hippotherium antelopinum* and *Acerotherium perimense*. (Ferruginous conglomerate).

(*c*). MIOCENE. Yenangyoung stage.

course of the ferruginous conglomerate, I was obliged, owing to the steepness of the slope, to walk along the edge of the plateau above, and while doing so I noticed, about 40 to 50 feet below, a ledge of considerable extent formed by the ferruginous conglomerate. The situation was therefore thus: the strata dipping east at about 30° were cut into in the direction of the strike by a deep ravine with a steep, sometimes nearly vertical, slope on the eastern side, along which the ferruginous conglomerate cropped out. At one particular locality all the soft, sandy beds had been removed from the edge of the plateau down to the surface of the ferruginous conglomerate, and being softer than the latter the erosion had worked quicker above than below the ferruginous conglomerate. (see Fig. 2).

The exposure of this conglomerate measured, so far as I recollect, 60 to 80 feet, in a north-and-south direction, and 25 to 30

feet in the direction of the slope, *i.e.*, measured from the edge to the spot where the conglomerate disappeared under the newer beds at the foot of the precipice. The thickness was 12 to 15 feet, and apparently only a very small part of the top of the conglomerate had been removed. The conglomerate was neither very hard, nor very soft; so far as I remember, quartzite-pebbles were absent or very scarce, so that it consisted chiefly of a mass of irregularly shaped nodules of earthy hydroxide of iron, loosely cemented together.

As the exposure seemed a good one to search for fossils, I climbed down, and the first thing I found was the molar of *Hippotherium antelopinum*, still embedded in such a way that only the grinding surface and part of the side were visible. I distinctly remember that I had some difficulty in digging it out with a knife, because I was afraid of using the hammer for fear of damaging it. While thus engaged I noticed some quaint looking flint-flakes, close to the molar, and I also distinctly remember that I wondered at them because of the absence of other quartz pebbles. Quite close to the molar was the largest of the flakes, (Fig. 1, 1a) *imbedded in such a way that about two-thirds of its length was still in the conglomerate, one of the ends sticking out.* On looking further about I found some more, all imbedded in the conglomerate, but I cannot of course now remember the way in which each single specimen was imbedded. Such is the history of the find.

Mr. Oldham, however, describes the locality in quite a different way. "The site," he says, "is on a spur running out into one of the valleys which have been cut back into the plateau; the crest of this spur falls somewhat rapidly, and then rises slightly to the outcrop of the ferruginous conglomerate, whose exposure on the crest of the spur is, to the best of my recollection, about 50 ft. long by 8 to 10 wide. No vestige of soil or sand is here, all having been removed by rain and wind, but there is a thin coating of ferruginous gravel overlaying the solid rock, and it was on this surface, as pointed out to me by Dr. Noetling, that the flakes were found." Now, this description conveys quite a wrong idea of the locality; not that I would blame Mr. Oldham, for his visit of a quarter of an hour can hardly have impressed the situation distinctly on his mind. The statement of "the thin coating of ferruginous gravel overlaying [*sic*] the solid rock" is, however, absolutely wrong. The exposure is formed by the top of the ferruginous conglomerate itself, and here there is no thin coating of ferruginous gravel.

As I have already mentioned the second locality where similar flakes were found, it remains only to add a few words about the polished bone. I found this specimen just at the spot where the low remnant of a ridge still divides the two ravines, about a quarter of a mile to the north of the place where the flints were found, and about 15 to 20 feet, perhaps a little more, above the zone of *Hippotherium antelopinum*, in a small streak of conglomerate, partly imbedded in the overlying sandstone. Fig. 3 will give an idea of the situation.

The lenticular conglomerate looked like a heap of shingle, and when taking out the bone, I noticed at once that the articular ends were polished in a remarkable way. It looked exactly as if it had been rubbed with force at both ends on a hard stone. If I remember rightly, at one end the condyle was rubbed off for about one-third of its width, and there were several facets. Otherwise the bone was well preserved. It was lying, as shown in Fig. 3, with the ground surfaces resting on the underlying sandstone; the dotted lines in the figure represent the parts rubbed off. The sketch is purely diagrammatic; but the bone will eventually be properly described and figured. Only two processes which could have produced such facets, can be imagined: glacial action, or human agency. This, however, can hardly be accepted as proof of glacial action in Burma during Pliocene times, and there remains only the one alternative. While forced to present the evidence in this incomplete fashion, I would not lay too much stress on it; but I am led to mention it, since in the *Neues Jahrbuch für Mineralogie* for 1896 (vol. i., p. 224) Professor Dames has described

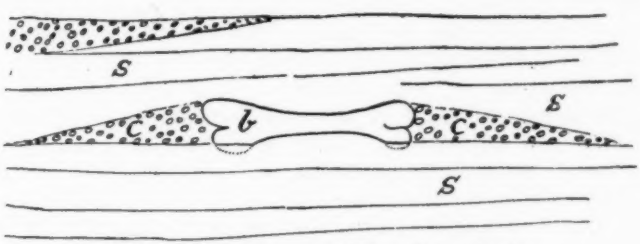

FIG. 3.—SECTION SHOWING WORN BONE, *in situ*.
s, sandstone; *c*, conglomerate; *b*, bone.

the shoulder-blade of a diluvial horse, exhibiting similar loss of substance at the upper end, and has unhesitatingly attributed this to human agency.

To sum up: in the neighbourhood of Yenangyoung curiously shaped flint-flakes, the shape of which it is difficult to explain by any other than human agency, were found at two localities in beds of Lower Pliocene age. It is absolutely certain that they were *in situ* when found at one locality and more than probable that they were so at the second. If their shape is attributed to human agency, additional evidence for this theory is afforded by a remarkably polished femur or humerus, found in the same beds.

FRITZ NOETLING.

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II.

Human Evolution.

III.—Mr. Wells Replies.

MR. COSTE makes some illuminating criticisms of my sketch of a theory of human progress[1] and, I must admit, forces a certain modification of phrase upon me. But it does not appear to me that his objections justify his description of them as "fatal." My argument was that, save for culture, for the developing artificial factor, "man is still, mentally, morally, and physically, what he was during the later Palæolithic Period." For the effective development of a subsidiary argument I have already restated that conclusion in an aggravated form.[2] And I see no reason to abandon it.

The main issue between Mr. Coste and myself arises out of a very simple (and probably very frequent) method of misunderstanding. When one speaks of a species, as I speak of "man" in the proposition I am defending, one may have in mind one of two things, (*a*) the normal or average type or (*b*) all the individuals of the species collectively. To be frank I did not clearly see my proposition in the light of the second sense, until I read Mr. Coste's article. My position is that the mean human being has not perceptibly progressed, and may just as possibly have retrograded. But obviously (if only on account of the undeniable numerical increase of the race) the range of variation must be more spacious about that mean than in the later Palæolithic period.

Now Mr. Coste's opening considerations, unless I misunderstand him, amount simply to this, that I have understated the variability of man by assuming that it is only equal to that of the rabbit. He uses the rather vague word "plasticity," but that I take it is his meaning. And he alleges that man is a domesticated animal, an animal removed from his natural conditions, and therefore exceptionally liable to vary. The whole of the question of enhanced variability under domestication would admit I believe of a profitable analysis, but that would be out of place here. My point would be that practically nothing is known of the things that die young in a wild species. But as I said

[1] "The Artificial Factor in Man." *Fortnightly Review*: Oct., 1896.

[2] "Morals and Civilization." *Fortnightly Review*: Feb., 1897.

in my original article, "natural selection is selection by death"—and save for variations affecting fecundity, I fail to see how this greater amplitude of variation (if it obtain) can affect the average product in the case of civilised man. And "another potent cause of variation," he reminds me, "is cross breeding." But the very readiness in racial interbreeding which increases man's tendency to vary, interferes with that process of segregation which (under conditions of general security) is so necessary to the establishment of variations. Neither of these considerations really affects my essential argument of the average man's present stability as far as natural selection goes, and, since Mr. Coste advances no other matter, I do not see that I need deal further with his culminating statement of man's "wonderful plasticity," except by putting a flat denial to his flat assertion. To my mind a great rapidity of multitudinous reproduction must necessarily be the first factor in the estimate of specific plasticity—the ability that is of a species to weather an unexpected cape in the shore-line of circumstance. And we must always remember in discussions of this nature that our discrimination of differences between our fellow men must necessarily be vastly greater than between animals, and that, in clothing and other material, man has an incalculable means of accentuating idiosyncrasy.

Setting aside this issue of relative variability Mr. Coste proceeds to a general attack upon my arguments, an attack based upon the confusion between the intension and extension of the word "man" to which I have already alluded. He begins by stating that my conclusion "that each of us *at birth* is scarcely distinguishable, mentally and morally, from Palæolithic Man, necessarily implies . . ." and he presents a dilemma. But I said nothing of "each of us," and with that his main case against me effectually collapses. I am quite prepared to admit that there are children born in each human generation to-day, potentially viler, more angelic, more stupid, more intellectual, more bestial, than there were born in an average generation of the later Stone Age. I think it will be apparent that Mr. Coste does not hit me, because he does not clearly see where I am. But that he does not do so is, I think, as much my fault as his, inasmuch as I did not make it clearly evident that I was dealing with the specific type.

I may perhaps take this opportunity of restating my view, which is that, *allowing for changes in the numerical ratio of races*, the *average* man is still mentally, morally, and physically what he was during the later Palæolithic Period. I would accentuate "later," because the stage I intend presents man already with speech, a rudimentary family organisation, agricultural beginnings, a wide distribution and therewith the main lines of racial differentiation. From that stage his history has been a history of aggregating communities with a steady fall of the death-rate. Over larger and larger and finally confluent areas natural selection has, I hold, practically ceased her elaboration

of him, until now the great mass of mankind is left to the new and semi-conscious process of elaborating mental environment.

My article was in no sense an "alarmist" one, but the implications of my view are very far-reaching, as I have tried to indicate in my second *Fortnightly* article. The tendency of a belief in natural selection as the main factor of human progress, is, in the moral field, towards the glorification of a sort of rampant egotism—of blackguardism in fact,—as the New Gospel. You get that in the Gospel of Nietzsche. But from the standpoint of my article the obvious gospel for the future is the gospel of discipline and education. As a writer of books for the general reader, and a mere interpreter and amateur of biology, my interest in these theories lies chiefly in their application. I feel no doubt whatever that the adequate discussion of this fundamental question is (if I may use a battered but expressive phrase) one of the crying needs of the age. After Darwin it has become inevitable that moral conceptions should be systematically restated in terms of our new conception of the material destiny of man.

H. G. Wells.

Heatherlea, Worcester Park, Surrey.

It is a pleasure to conduct a controversy with so candid an opponent as Mr. Wells; but I am warned that my further share in such a controversy must be confined to a note. After reading his first article I thought that I understood Mr. Wells: his elucidation of his argument has however shaken my confidence. Putting aside, for want of space, all his other arguments, I infer that our main difference lies in this—that Mr. Wells admits the peaks of inborn human greatness to be higher now than before, but contends that the depths are also lower, whilst the median line is stationary. I gravely doubt the justness of such pendulum analogy; and can safely leave Mr. Wells to be tackled by a vastly more dangerous foe than myself—Prof. Weismann to wit. My own position has been, and is (see "Towards Utopia"), that the loftiest peaks do *not* arise out of plains but only out of mountain ranges. Mr. Wells will easily appreciate my analogy, which is diametrically opposed to his pendulum analogy. The onlookers must decide between us.

I believe that to a large extent we approached the question from different standpoints. I rely especially on the arguments from heredity and genius; which Mr. Wells seems inclined to ignore. Also I perceive that he has prudently ignored what I consider to be several of the strongest arguments in my criticism. Our readers will readily perceive which.

F. H. Perry Coste.

[Part IV., Mr. Archdall Reid's re-statement of his position, will, it is hoped, appear in our next.—Ed. Nat. Sci.]

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III.

The Migration of British Birds.[1]

THE object of this article is to call attention to the results disclosed by the first systematic attempt, on a sufficient scale, to investigate the phenomena attending the migratory movements of the birds observed on our coasts. It must be distinctly born in mind that in Mr. Eagle Clarke's Digest no attempt has been made "to deal with the problems connected with the causes of the phenomena, the evolution of the migratory instinct, or other purely theoretical aspects of the general subject," but the aim has been to establish actual facts, from which alone the deductions are drawn. In this respect the Report is rightly said to differ from almost everything which has hitherto been published on the subject.

In the year 1879 that indefatigable naturalist, Mr. Harvie-Brown, printed in the *Proceedings* of the Natural History Society of Glasgow an "Ornithological Journal of the winter of 1878–79, with collected notes regarding its effects upon animal life, including remarks on the Migration of Birds in the Autumn of 1878 and the Spring of 1879." Again, in the following year he contributed to the same society a second report, bringing his observations down to the 30th of September, 1880. These two valuable reports referred to Scotland only, but in May, 1880, the scheme was enlarged, and their author, in conjunction with Mr. Cordeaux, published in the *Zoologist* for that month a "Report on the Migration of Birds in the Autumn of 1879.' In this report Mr. Harvie-Brown contributed the section for the East and West Coasts of Scotland, and Mr. Cordeaux that for the East of England; they were also assisted on this occasion by a large number of keepers of lighthouses and light-vessels on both coasts. This valuable additional help was due to the liberality of the Elder Brethren of the Trinity House and the Commissioners of Northern

[1] Report of the Committee, consisting of Professor A. Newton (Chairman) Mr. John Cordeaux (Secretary), Mr. J. A. Harvie-Brown, Mr. W. Eagle Clarke, Mr. R. M. Barrington, and the Rev. E. Ponsonby Knubley, appointed to make a Digest of the Observations on the Migrations of Birds at Lighthouses and Light-vessels, 1880-1887. Digest prepared by Mr. W. Eagle Clarke and presented to the British Association at Liverpool, 1896. *Rep. Brit. Assoc.* for 1896, pp. 451-477. Copies of the Digest may be obtained at the offices of the British Association, Burlington House, W., post-free, at 7d. each.

Lights, who permitted their officers to fill up returns sent to them for that purpose. The last-mentioned report was brought by Professor A. Newton before the meeting of the British Association held at Swansea in 1880, and a committee was then appointed to carry on the work under the auspices of the British Association. This committee worked for eight years, 1880 to 1887, both inclusive; and at the meeting of the Association held last year in Liverpool it presented a report consisting of a "Digest" of the "Observations on the Migrations of Birds at Lighthouses and Lightvessels" for the above period. This "Digest," ably prepared by Mr. William Eagle Clarke of the Edinburgh Museum of Science and Art, is the outcome of seven years' study of the mass of data supplied to the committee, and has necessitated the tabulation of at least 100,000 records, culled from several thousands of forms filled in by the light-keepers, in each of which forms the number of species mentioned was great and the dates of observation wide-ranging; some estimate may thus be formed of Mr. Clarke's labour, but it is harder fully to appreciate his skill and judgment. Even now Mr. Clarke does not claim to have exhausted the material, but believes that further research, to which he is still actively directing his attention, will yield results of a useful, and probably of an important, nature.

Before discussing the results, it may be well to explain how the material was obtained that is embodied in the Annual Reports issued by the Committee. The Report for 1887 (the last issued) consists of 175 pages, accompanied by an excellent outline map of Great Britain and Ireland, including the Orkney and Shetland Islands, showing the stations from which returns were made. The stations are: 4 in Iceland and the Faröes; 27 on the East Coast of Scotland, and 35 on the West Coast; 36 on the East Coast of England, and 44 on the West Coast of England and Wales; 4 in the Isle of Man, and 40 on the Coasts of Ireland. Information was also received from the following outlying stations: Heligoland, Zealand, Malmö (Sweden), the Casquets Lighthouse, and the Harnois Lighthouse (Guernsey). There are 195 stations in all. It will, however, be observed with regret that the South Coast of England from the South Foreland to the Start is not represented. From a large number of these stations returns were regularly received, while much information was also afforded by observers on the coast and culled from natural history journals. The observations from each group of stations were arranged under the month, or even day, by the recorder for the district, giving locality, species seen, direction of the wind, and other particulars of interest. In many cases where the identification of the species was doubtful, the wings of the birds killed at the lighthouses and vessels were sent for determination. Each recorder added such particulars as he deemed to be of value. It was this vast mass of original material furnished to the committee during eight years that Mr. Clarke undertook to examine *de novo*. It was this remarkable girdle of observing

stations, forming a nearly complete circuit of the British Isles, with outliers in the most important directions, that constituted the essential feature of this exceptionally valuable series of observations, and the recorders again and again acknowledge the cheerful and intelligent co-operation of the light-keepers, without whose aid the plan could not have been carried out. Thus a record has been obtained such as has never before been attempted in this or any other country, the special character of which, to use the words of the "Digest," "can only be fully appreciated when it is realised that, in order to study the phenomena of bird-migration in the British Islands, it is necessary that the data upon which any deductions may be satisfactorily or safely founded should be based upon observations taken synchronously at stations encircling the entire coast." This cardinal and all-important condition has been now for the first time fulfilled.

The migratory movements appear to be exceedingly complex and subject to many influences, but it was found (1) that our shores form an accustomed highway and resting-place eminently favourable in situation and directly in the course of the legions of migratory birds which annually make a double journey between their northern summer and their southern winter quarters; these we may term "Birds of Passage." (2) "Our islands have a vast bird population of their own, and the majority of these birds belong to purely migratory species. Some of them are 'Summer Visitors' from the southern regions, or 'Winter Visitors' from continental Europe, Iceland, &c." (3) There are many birds sedentary in our islands, but migratory within these limits; these may be termed "Partial Migrants." (4) Mainly owing to our variable climate there are frequent "Migrations within the British area itself, and intermigration with the islands off our western coasts, especially with Ireland. These occur during the winter months, and hence they will be alluded to as 'Winter Movements.'" Often, owing to a combination of meteorological conditions, more than one of these movements may be observed in progress simultaneously.

Two main routes are found to be taken by the birds during migration: those species which spend the summer in Northern Europe pass along our east coast, taking their departure at some point or points between the north coast of Norfolk and the Shetland Islands, proceeding in a north-easterly direction, and returning by the reverse route in the autumn; those birds which visit us from Western Europe arrive in spring on our south-easterly coast, landing between the Wash and the Kentish shore, and return in autumn the same way; this latter is known as the East and West route. There are no essentially northern birds recorded in these latter flights, the species being suggestive of Central Europe, or of countries lying even still more to the eastward. The birds landing on the southern section of England spread either northward, up the east coast, or pass to the west along our southern shores; and it is pointed out that occasionally these

immigrants, while passing northward along the eastern seaboard, actually cross the movement of the coasting emigrants proceeding southward. It is also found that the west coast does not receive any immigrants direct from the continent.

The spring movements on the west coast of England and the east coast of Ireland are trifling in comparison with those on the east, and it seems probable that those birds which pass to the Faröes and Iceland pursue the former route. The return autumn journey is by no means so simple on the west coast as on the east; for Ireland, the Isle of Man, the Hebrides, and the extremely irregular coast line exercise their varied influences. Mr. Clarke thus describes the course taken:—"The general route followed by these departing birds has its north-western source in the Outer Hebrides, and after leaving Barra Head it joins an important stream from the Inner Hebrides at Skerryvore. The course then followed is *viâ* Duheartach, Islay, the Wigtonshire coast, the Isle of Man, Anglesey, and the South Bishop (off Pembrokeshire). Finally the south-western coast of England is reached (possibly in part by an overland route across Devonshire and Cornwall) between the Scilly Islands and Start Point." In its course south it receives several tributary streams at various points, and "at the Bristol Channel others from Western England and Wales, and often from the south-eastern coast of Ireland." The coasts of Ireland are not in themselves a main highway, and "the majority of the birds on the shores of the sister isle are probably the migratory members of her own avifauna."

Astonishment has often been aroused by the wonderful migratory flights to be witnessed at the proper season on the little island of Heligoland, so graphically described by the late Mr. Gätke, and it could not fail to be of interest to ornithologists, especially those residing on the east coast, to learn whether and to what extent these migratory hosts affected the arrivals on their own shore. With no little disappointment, therefore, we learn that "a study of the phenomena of migrations at the stations on the east and west sides of the North Sea compels the investigator to come to the conclusion that Heligoland and Britain draw their migratory hosts from different sources," and that although "it is not impossible or improbable that birds may *occasionally* cross the German Ocean by an east to west flight in the latitude of Heligoland, our data lead us to believe that such cases are the *rare exception* and not the rule." There is no more astonishing feature in the whole range of this wonderful subject than the arrival on our east coast of birds whose natural habitat is Eastern Asia, and which must have crossed the whole of Europe, finishing with the passage of the North Sea. Some of these, too, are delicate warblers of the smallest size, and arrive here after the British representatives of their kind have left us for the south. The past autumn has been remarkable for these strange occurrences.

Of equal interest with the discussion of the routes taken is the section devoted to "Seasonal" migration.

The difference between the behaviour of the birds on their autumn and spring passages is very marked. At the close of the summer the great business of the year—procreation—is over, food is still abundant, and the birds pass leisurely along, their numbers swelled by the broods of young ones; but in spring the conditions are quite different, they hurry on to their breeding-grounds, and the opportunities for observation are far more limited.

Commencing with the Autumn Immigration, it is remarked that, notwithstanding the month of July being the height of the Arctic summer, certain birds, such as the whimbrel and knot—and a few others less frequently—are recorded as arriving in that month. In explanation of this fact, Mr. Clarke remarks that the majority of these early arrivals are probably non-breeding birds which have not, perhaps, passed far beyond the limits of Britain on their spring journey northward; and in support of this conclusion he points out that these migratory pioneers, so far as reported, are all adults. In August the return movement of twenty-six species of birds, whose summer haunts lie entirely beyond the British area, is recorded; and, in addition to these, the northern representatives of several species which are summer visitors to Britain also put in an appearance. In September a marked increase takes place in the number of immigrants, both as to species and individuals; over forty species which do not summer in Britain, including those already recorded for August, are enumerated. In October the return-current reaches its maximum, and it is in this month chiefly that the great "rushes" of migrants arrive on our shores; these rushes, as will be explained, are entirely due to meteorological conditions. Forty-seven species of regular birds of passage are recorded in this month, besides many other birds which breed in both Northern Europe and Britain. It is noticed, however, that signs of slackening are apparent in some respects, for certain species have already ceased to occur, and a few others appear less numerously. The migratory movements in November are on a much reduced scale. A few northern summer birds which do not breed in Britain, such as the redwing and fieldfare, still arrive early in the month, often in considerable numbers, also a few northern species, which we are accustomed to regard as hard-weather birds, become more numerous; but Mr. Clarke found that "after the middle of the month the immigration of such birds as spend the summer in the north entirely ceases, with the exception of certain marine species (ducks, gulls, grebes, swans), whose late movements to the south are dependent upon severe weather conditions. This is entirely contrary to the views hitherto propounded regarding the limits of these movements, but it is, nevertheless, a fact well sustained by the enquiry."

Besides those derived from the north, there are certain Autumn

immigrants that reach our shores by a westerly movement along the east and west route. These birds cross the narrow passage of the North Sea, and land on the south-eastern shores of England, performing the journey by daylight. The chief arrivals are in September and October, ordinarily ceasing in the middle of November; but in exceptionally severe weather they are again renewed, the birds at that time chiefly passing westward to the warmer portions of the kingdom. The latter movements, however, are exceptional, and due to meteorological causes.

The Autumn Emigration begins in July, and is probably led off at the end of that month by the adult cuckoos and swifts. Towards the close of the month also there are occasional records of movements of small birds, such as wheatears, redbreasts, warblers, pipits, swallows, etc.; but Mr. Clarke adds a caution that many of this latter class are "outcasts," whose parents are engaged with second broods, and they may, in their wanderings, reach the coast where their appearance would be duly recognised. During August, however, the retreat sets in in earnest, and a large number of migratory birds take their departure; with them are probably some species which are mere birds of passage on their way south from more northerly breeding-stations. September witnesses the "height and close" of the emigration of the bulk of the smaller British summer visitors; most of these are absent from the records of October, which month witnesses the departure of the laggards. The partial migrants are, however, much on the move in October, their numbers doubtless being largely recruited by arrivals of the same species from the north; but the first half of November brings the movement to a close, and the ordinary southward retreat, both of birds of passage and of British emigrants, ceases.

The first indications of the Spring Immigration sometimes occur as early as February, but these are almost entirely confined to partial migrants within the British area, such as pied wagtails and lapwings; especially mild weather may, however, bring us an occasional wheatear, or even a solitary swallow. March witnesses the return of many species which had quitted our shores in consequence of the severity of winter, and generally a few of our regular summer visitors, such as the whinchat, wheatear, willow wren, chiffchaff, and even an early sand martin or cuckoo; but we must wait till April for the first pronounced influx of the summer migrants. In this month the arrival of thirty-seven species is recorded in the chronicles; the birds of passage, which only visit us on their way to their northern breeding-stations, also begin to put in an appearance at this time. Early in May the spring immigration reaches its full force, and before the close of the month comes practically to an end. The number of passing migrants is also greatly increased, and by the middle of June the bulk of the Polar breeding birds have passed, although some few which go very far north, such as the knot and the grey plover, may linger a little longer.

Some interesting facts are to be gleaned from the records of these spring arrivals. Thus, it is found that the earliest arrivals appear in the south-western, that is, in the warmest section of the British area; also that the earliest arrivals amongst the summer visitors are those individuals of the species with more extended range which stay to breed in Britain; this is exemplified by the snipe, some of which are already breeding in this country before the more northerly breeding birds of the same species have all passed on; the same may be said of the great crested grebe. Other observations are quoted in proof that the migrants bound for the far north are the last of their kind to appear in the British area.

During all this time the corresponding spring Emigration is going on, and those birds which have wintered with us are leaving for their summer haunts. In February the geese begin their northern movements, and larks and rooks are proceeding to the Continent by the east and west route. In March the northerly current becomes more pronounced, shore-larks, geese, ducks and divers taking their departure, and the Continental outpour gains in intensity. In April no less than thirty-four species which have wintered with us are recorded as departing for their northern summer haunts, and the final departures by the east and west route take place. May sees the maximum amount of emigration to the northern breeding grounds, both of species which have wintered with us and of birds of passage. Fifty-three species of regular emigrants are recorded for this month, but it may be the middle of June or even later before the last of the Polar breeding birds have taken their departure. It is noteworthy that this great stream of migrants passing to the north-east, as well as the exodus by the east and west route, each takes place from its allotted section of the eastern coast, "a few only of the species, such as the redwing, wheatear, white wagtail, barnacle goose, swans, whimbrels, etc., passing up our western coasts, possibly *en route* for Iceland."

There remains one other important section of the "Digest" to notice, that is the one devoted to Meteorology, and for the purpose of establishing "the actual relationships between migratorial and meteorological phenomena." The material at the disposal of the committee is said to be both extensive and reliable, the "Daily Weather Reports," based upon observations made at fifty-four widely-distributed stations, and issued by the Meteorological Office, having been used. As Mr. Clarke explains at length, migration is controlled, if at all, by meteorological conditions obtaining in the region from which the birds are starting, and obviously not by those in the region to which they are going. Thus, British immigrants are affected by Continental conditions, and British emigrants by our home conditions. "As a result of an extensive series of comparisons instituted between the two sets of phenomena, it has been ascertained that they are most intimately associated, and that a knowledge of the

meteorological conditions prevailing during the movements in most instances contributes in no small degree to a correct interpretation of their precise nature and the seat of their origin." Unless, therefore, the conditions at the point of departure are favourable to emigration, or are such as to render the journey imperative, it is either deferred or undertaken most reluctantly.

These weather conditions are of an exceedingly complex nature, and Mr. Clarke is at some trouble to explain their origin and effects upon migration: under ordinary conditions the migratory movements proceed as usual; in somewhat unsettled weather they may be in some degree quickened, but are still normal; exceptionally stormy weather arrests all migration, and the barred-up stream is detained for a favourable opportunity; its eventual release results in one of those "rushes," with which dwellers on the east coast are so familiar, but which never fails to excite their astonishment.

Temperature is also an important factor in these movements, and indeed a decided fall of the thermometer is a frequent accompaniment of the anti-cyclonic conditions with atmospheric calms, so highly favourable for sustained flight. Of course these conditions apply equally to both spring and autumn movements. It does not follow, however, that the favourable weather prevailing when the journey is commenced will be sustained during the whole of its course, and possibly the migrants may encounter very unsuitable weather before reaching their destination; under these circumstances they arrive in a state of great exhaustion, and many individuals probably perish *en route*.

Fog, which often prevails during the autumn and winter periods of flight, appears greatly to inconvenience the migrating birds, and it has been noticed that even non-migratory birds, such as the sparrow, have occasionally lost their bearings through it.

The simultaneous autumnal influx and efflux already mentioned has been found to occur in periods when anti-cyclonic conditions prevail over an area sufficiently wide to cover both the points of departure and arrival, the result being "a great simultaneous inpouring of birds on our east coast, and a general outpouring from *all* British coasts of migrants of many species." The comparatively simple east to west route and the more complex northerly route are both governed by the same meteorological influences, and take place chiefly during calm and cold anti-cyclonic periods, being interrupted by rough weather and renewed with increased energy on the return of suitable atmospheric conditions.

Another result of the study of the returns is the more just appreciation of the influence of the winds on migration. Mr. Clarke, after a careful study of the evidence, arrives at the conclusion "(1) that the *direction* of the wind has no influence whatever *as an incentive to migration*; but that (2) its *force* is certainly an important factor, inasmuch as it may make migration an impossibility, arrest to a

greater or less degree its progress, or even blow birds out of their course." The fact that easterly and south-easterly winds prevail during the great autumnal migratory movements is shown to be the direct result of the type of weather favourable to such movements, and there appears to be no reason, other things being equal, why W., N.W., and S.W. winds, if not too strong, should not be in every way suitable for migratory purposes, except that these winds indicate cyclonic disturbances in North-Western Europe, which are fatal to migration between that region and the British Isles.

It has been pointed out that occasionally the migrating birds pass into gales *en route*, often with disastrous consequences.[1] Should such disturbances continue even the most hardy birds suffer severely. It has again and again happened that the tide-line has been thickly strewn with guillemots, razor-bills, and puffins; little auks have been known to stray even into the streets of inland towns, flocks of skuas have been met with far from the coast, and even the ocean-loving fulmar has been driven shoreward in numbers. To this cause we owe not only the unusual spectacle of storm-petrels flying inland, but also the record of some of the rarest members of this remarkable family, which probably spend their whole existence as ocean wanderers, with the single exception of a brief visit to the shore at the period of reproduction. If these dire effects are produced on birds possessed of such marvellous powers of flight and protracted endurance, what must be the fate of the delicate summer-migrants when buffetted by the stormy winds in mid-sea!

The above are some of the deductions derived from a careful study of the voluminous data amassed by the British Association Committee on Migration, and it is most satisfactory to learn that Mr. Clarke does not consider he has by any means exhausted the material at his command, and is even now engaged in working out the details for each species. Ornithologists must thoroughly endorse the hope of the Committee that he will receive some encouragement to continue the first really scientific attempt to work out the phenomena attending the migration of birds.

THOMAS SOUTHWELL.

Norwich.

[1] In the *Norwich Mercury* for November 11, 1786, it is stated that the master of a Newcastle collier, being within a few leagues of Easton Ness, on the coast of Suffolk, sailed through water that appeared unusually black, and on inspection it was found to be occasioned by a vast number of drowned birds, and those birds woodcocks.

IV.

The Horn Expedition to Central Australia.[1]

THE expedition of the results of which these volumes furnish an account, was inaugurated and its expense defrayed by Mr. W. A. Horn, who in order to give it a semi-national character invited the Premiers of the principal Australasian Colonies to nominate scientific representatives. In this way Professors Baldwin Spencer and Ralph Tate, Dr. E. C. Stirling, and Mr. J. Alexander Watt were selected, whilst Mr. C. A. Winnecke was chosen as surveyor and meteorologist. These constituted the scientific staff, and in addition there were camel-drivers, collectors, prospectors, &c., the party numbering sixteen in all. The object of the Expedition was "the scientific examination of the country from Oodnadatta to the M'Donnell Range; the collection of specimens illustrative of the fauna, flora, and geological structure and mineralogical resources of that region, and the illustration by photography of any remarkable natural features of the country traversed; the securing of photographs of the aborigines in their primitive state, the collection of information as to their manners, customs, and language, and the reproduction of their mural paintings." How far these aims were achieved the following paragraphs endeavour to show. We may arrange them under the headings of the several reports.

Narrative.

Professor Baldwin Spencer, in the course of about 130 pages, gives an account of the journey, dividing it into five sections, and treating of three different types of country, namely, the desert or eremian—a term frequently, but erroneously, applied to the centre of Australia as a whole—and the steppes, which are subdivided into lower steppes and higher steppes. The lower steppes extend over the area occupied by the great Cretaceous formation, and are characterised by gibber plains, loamy flats, and terraced hills capped with desert sandstone. "At Lake Eyre the land is 39 feet below sea level, gradually rising to a height of one thousand feet at its northern limit." The higher

[1] Report on the Horn Scientific Expedition to Central Australia. Part I. Introduction, Narrative, Summary of Results, Supplement to Zoological Report. Pp. xii., 220, pls. xi. and map. Part II. Zoology. Pp. iv., 431, pls. xxix. Part III. Geology and Botany. Pp. 204, pls. ix. Part IV. Anthropology. Pp. 200, pls. xix. Edited by Professor Baldwin Spencer, of Melbourne University. London: Dulau and Co.; Melbourne: Melville, Mullen & Slade. 1896. Price 21s., 30s., 10s. 6d., and 21s. respectively.

steppes consist of ridges of Ordovician and Precambrian rocks, with an average elevation of 2,000 feet. The climate has rainy seasons alternating with periods of extreme drought; the former are always short, but the latter may be very long. The gibber plains (from a native Queensland word, meaning "a stone") are a striking feature of the lower steppes; they are covered with a layer of purple-brown stones, varying from an inch to perhaps a foot in diameter, smoothed by the constant friction of wind-borne sand grains; they merge into loamy flats, where the Cretaceous rocks are not capped with sandstone.

Professor Spencer is of opinion that the development of thorns, so conspicuous in many of the desert plants, is an adaptation to climatic influences and has very little, if anything, to do with protection against animals. A similar view was, we believe, propounded some years ago on independent evidence by Professor Patrick Geddes. A very striking picture is drawn of the contrast between the appearance of the country in the dry and wet seasons, especially in regard to animal life. In the former everything is parched and silent; dead shells of molluscs, carapaces of *Estheria*, and footmarks of frogs are the only traces of life. In the latter, the trees have put out a fresh growth of leaves, many kinds of birds have suddenly appeared in flocks; the croaking of frogs is incessant, whilst crustaceans and water-beetles swim about in the pools. Numerous observations were recorded on the colours of animals, the net result of which is thus summarised by Prof. Spencer:—"(1) That in the dry season when food is scarce and the sum total of activities is at the lowest point, the various animals such as frogs and lizards are dull coloured, but that this dull coloration has not of necessity (as in the case of *Amphibolurus barbatus*) any definite relation to the environment, though it is often in general accord with it. (2) That in the rainy season when food is plentiful and the sum total of the activities is at the highest point, various animals are highly coloured, but that this often brilliant coloration has nothing to do either with choice of partners (reaching its climax after pairing has taken place) or with protective coloration—sometimes even it renders the animal more conspicuous."

Regarding the relative advantages of rodents, for example, and marsupials in the struggle for existence, the following observation is of interest. The former take care of themselves at an age when the latter take refuge in the maternal pouch. This not only handicaps the marsupial parent in flight, but has the result that if she be captured her family perishes too, whereas if such a mischance happen to the rodent only one life is sacrificed.

With observations and discussions such as these, Professor Spencer varies the descriptions of the journeys from one water-hole to another, or over the sandhills in the waterless waste to visit Ayers Rock and Mount Olga,—two remarkable masses standing up from the level plain, of which he gives us vivid and striking pictures with both

pen and camera. Certainly this narrative, brief though it is, will take rank among the classics of this form of literature.

Zoology.

THE volume which contains the zoological results of the Expedition contains 431 pages and is illustrated by 29 plates. It is the work of several authors. Professor Spencer, besides editing the whole, treats of the Mammalia (excluding Muridæ), Amphibia, Crustacea, and contributes Appendices on the stridulating organ of *Phlogius crassipes* and on an earthworm (*Acanthodrilus eremicus*). Mr. North describes the Birds; Messrs. Lucas and Frost, the Reptiles; Mr. Zietz, the Fishes; Prof. Ralph Tate and Mr. Hedley, the Mollusca; Mr. Lower, the Lepidoptera; the Rev. T. Blackburn, the Coleoptera (except the Carabidæ for which Mr. T. G. Sloane is responsible); Mr. H. R. Hogg, the Araneidæ; Mr. J. G. O. Tepper, the Orthoptera; Mr. W. W. Froggatt, the Honey-ants; and Mr. E. R. Waite, the Muridæ.

Nineteen species of Mammalia are known from Central Australia, and of these five are peculiar to it. The following are new to science:—*Phascologale macdonnellensis*, *Sminthopsis larapinta*, *S. psammophilus*, and *Dasyuroides byrnei*. *Notoryctes typhlops* is probably the sole representative of the only family confined to this region. Professor Spencer has now had over forty specimens in his possession, and he and Professor Stirling are preparing an account of the teeth, fur, and reproductive organs. It is interesting to note that a rudimentary pouch may be present in the male and that the reproductive organs, which have been examined by transverse sections, show the animal to be a modified marsupial and in no sense a link between this group and the monotremes. As regards the jumping forms (*Hapalotis* and *Antechinomys*) it is remarked that "it is really somewhat difficult to see what is exactly the advantage gained by such small forms of animals in this saltatory mode of progression. . . . Both are far too small to spring over the grass tussocks, and perhaps the most noticeable point in connection with this matter is that the true mouse, which lives in great numbers in the same part and has not taken on this saltatory method, thrives just as well. . . . Possibly the real advantage in the saltatory method of progression amongst these small forms lies in the greater difficulty of pouncing down upon an animal travelling by leaps and bounds rather than in any advantage gained in the way of speed." It is curious that two animals so differently organised as *Hapalotis* and *Antechinomys* have the same habit and live side by side, the former very common, the latter extremely scarce. Mr. Edgar R. Waite discusses the Muridæ in a separate chapter.

The Birds were collected with great care by Mr. Keartland. Seventy-eight species are included in the collection, five of which are described as new, whilst the Princess of Wales Parrakeet (*Polytelis alexandræ*) is made the type of a new genus, *Spathopterus*, on account

of the spatulate extremity of the third primary of the wing in the male.

The Reptiles include forty species of lizards (nine new) and twelve of snakes (one new, the type of a new genus *Hornea*). The lizards belong to the families Geckonidæ, Pygopodidæ, Agamidæ, Varanidæ and Scincidæ. A great amount of variation has been shown to exist in many forms, and not a few so-called species are reduced by the authors to varietal rank. The following account by Professor Spencer of the fate of a specimen of *Tiliqua occipitalis* is interesting:—"Having my hands full of specimens, I asked a black fellow to look after it and not to let it escape, when to my surprise he simply put it down on the hot sand. It was perfectly alive when put down, . . . and when placed on the ground it began to travel at some rate, but after going five yards its movements became slower and before ten yards had been traversed they ceased and the animal was quite dead—simply apparently baked to death by contact with the hot sand."

The Amphibia, Professor Spencer tells us, are remarkable, firstly for the paucity of species, and secondly for the great number of individuals found at certain seasons. The characteristic forms belong to five species, four of which may be described as burrowing frogs. *Hyla rubella* is probably a direct descendant of some form which inhabited the region during more favourable climatic conditions; the other species have probably immigrated from the east or south east. *Chiroleptes platycephalus* is remarkable for the power of storing up water in its body, on account of which it is sought for and dug out by the blacks in seasons of drought. *Hyla gilleni* is described as new.

Of Fishes Mr. Zietz describes eight species, of which six are new, but there are no general notes or discussions of moment.

The number of Mollusca known to inhabit this region has been increased from three to twenty-five, of which only four extend beyond the area. "The facies of the fauna approximates more to that of subtropical and temperate West Australia than of any other part of the continent, and is in strong contrast with the highly differentiated fauna of tropical and sub-tropical Queensland, situated to the east of the Cordilleras, to which it is geographically equally near. The limited number of genera represented, together with the facts of their geographic distribution, would seem to indicate a primitive population, which has been maintained in an isolated condition by climatic and geologic changes." Mr. Hedley contributes an anatomical appendix, in which he advocates the view that *Xanthomelon* should be advanced from subgeneric to generic rank, and removes *Microphyura* from the Rhytididæ to the Endodontidæ, remarking that it would seem to be of high antiquity and of antarctic origin and is probably one of the most primitive of Australian snails.

The Crustacea are dealt with by Prof. Spencer and Mr. T. S. Hall. As regards their habits they may be divided into two groups:—"(1) Those which can burrow and so tide over a certain length of dry

season (*Astacopsis*, *Telphusa*). (2) Those which require that their eggs shall be dried up prior to development (*Apus*, *Estheria*, *Limnadopsis*, *Limnetis*, *Eulimnadia*)." The rate of growth of *Apus* and *Estheria* seems to be extraordinary: specimens of the former measuring 2½ to 3 inches were found, and there was reason to believe that these had developed from the eggs in a few days. Such capabilities are of obvious utility in a region subject to frequent and prolonged droughts.

Of Insects lists are given of several orders, but there is evidently much more work to be done in this department. Of special interest are the Australian honey-ants, of which Mr. Froggatt gives a particular account. These belong to the genus *Campanotus*, of which more than thirty species are known from Australia, yet only three of these have developed the honey-storing habit. The peculiarity consists in this, that certain individuals are set apart as receptacles and fed with honey by their fellows till their abdomen is hugely distended, and in subsequent periods of scarcity made to disgorge their precious burden.

Finally, we must mention the description of a stridulating organ in *Phlogius* by Prof. Spencer, similar to those which have already been discussed by Mr. Pocock (NATURAL SCIENCE, vol. vi., p. 44).

GEOLOGY.

THE Physical Geography, Geology, and Palæontology are dealt with by Prof. Ralph Tate, Mr. Watt, and Mr. Smeeth. As already mentioned, it would appear from their observations that the high ground of the McDonnell and other ranges is formed by Precambrian and Ordovician rocks, while the foot-hills consist of Cretaceous strata. The great plains are of post-Cretaceous age, and covered by a series of deposits regarded as intermediate between the Cretaceous and Eocene, and named Paleocene. Most of the valleys result from the erosion of Ordovician limestones by the rivers. The two lakes met with are rapidly drying up, and the largest, Lake Eyre, with an area of 5,000 square miles, is calculated to be 39 feet below the sea-level.

The determination of the great series of highly altered rocks as Precambrian is based upon their general resemblance to undoubted strata of this antiquity in other parts of Central and South Australia. Regional metamorphism is extensive, and large areas are occupied by eruptive rocks, of which several types (*e.g.*, diorites and dolerites) are described in a petrographical section of the Report. Foliation planes are abundantly obvious, and have been previously mistaken for planes of sedimentation; but there is a remarkable absence of contortions.

The Ordovician rocks comprise ripple-marked and false-bedded sandstone, quartzites, and limestones. No evidence of contemporaneous volcanic action was obtained by the expedition; but many typical fossils were found in the limestones. A post-Ordovician conglomerate was also noticed in some localities.

The Desert Sandstone, of "Paleocene Age," is a remarkable

deposit. It is never more than fifty feet thick, and is interesting as being the chief source of the Noble Opal so often obtained from Australia. This mineral occurs disseminated through the rock in minute fragments, though sometimes coating joints or fractures and replacing wood and shells.

Botany.

The Report on the Botany is the work of Prof. Ralph Tate. So far as systematic botany is concerned, he has been able to add eight new species to science, to record sixteen species new to South Australia, and 112 new to the Larapintine region. But the most interesting portion of his Report deals with the geographical distribution of the plants observed, with the influence of the physiography of the district on the present flora, and with the origin of the flora of this region. The author has already contributed a valuable paper on this subject, so far as it affects the whole continent, to the Australasian Association for the Advancement of Science, and he had hoped that in the McDonnell Range the explorers might find some of the pristine flora of early Tertiary times, which had died out of the lower-lying regions. In this, however, he was disappointed. Nevertheless, he comes to some valuable conclusions largely confirmatory of his previous views. These are briefly stated as follows. The Larapintine table-land was isolated, except perhaps in a northerly direction, during the deposition of the Upper Cretaceous beds. The marine submergence was replaced by a lacustrine area, which continued during the early Tertiary and into Pliocene times. During this period a cosmopolitan flora prevailed. In Post-Pliocene times a high state of desiccation was reached, which has continued till to-day. The cosmopolitan flora has largely disappeared and its place is occupied by an oriental immigration, more especially over the previously submerged areas.

Thus the flora of the Larapintine region is a mixture of endemic and immigrant (oriental) forms, and a most interesting statistical table shows that a large percentage of the oriental forms have burr-like or adhesive fruits rendering their immigration with that of animals coming over the land-areas possible.

It is unfortunate that Prof. Tate does not discuss more fully the point already touched upon by Professor Spencer in the Narrative of the Expedition relating to the spiny character of the plants making up the scrub and desert flora. That a dry and arid climate requires some modification of the plants will not be denied; but to argue that the spines have nothing to do with protection against animals, firstly, because there are practically no animals in that region, and secondly, because the camels the expedition introduced fed on the thorny acacia as well as on the juicy *Claytonia*, will not settle the question. The very absence of indigenous animals might be taken as proof that they had been driven away by the protective adaptations of the plants, in some cases by the spines and thorns, in others, such as the succulent

plants, by the distasteful or poisonous cell-sap. Nor is the fact that the plant is not protected against an enemy, which it has no need to fear, in the least surprising. Indeed it is what might be expected.

ANTHROPOLOGY.

THIS section of the Reports is the work of Dr. E. C. Stirling and Mr. F. J. Gillen.

For a primitive race, the aborigines of Australia are fairly numerous, the total population being estimated at 100,000; and when we bear in mind the fact that they cover an area of about 3,000,000 square miles, they may be considered to form a remarkably homogeneous group of people. In some anatomical features, such as the capacity of the cranium, the square orbits, the pronounced brow ridges, the shape of the vertebral column, and the form of the tibia, they are undoubtedly more ape-like than any other large race of human beings. On the other hand, in their stature, in the character of their hair and in other respects, they differ in a most remarkable degree from those primitive little groups of negroid people which are, or were quite recently, found in Tasmania, the Andaman islands, the highlands of the Philippines, the centre of Africa and elsewhere.

Now, our knowledge of the Australian race, so far as it is accurate and trustworthy, has hitherto been founded on the facts collected by travellers among the tribes of the coast or of the boundaries of the European settlements; and it has been a matter of some difficulty even to anthropologists to eliminate satisfactorily from the purely aboriginal features, those due to contact, in recent times, with the Malays, the Papuans and the European settlers. A thorough investigation of a tribe of Central Australians has been, therefore, a profound desideratum; and to the members of the Horn Expedition the thanks of the scientific world are due for the care and skill they have displayed in filling up the vacant places in our information.

If, however, the anthropologist expects to find in the volume now before us, anything very startling or novel, he will be doomed to disappointment. No living *Pithecanthropus erectus*, no little negroid race, practically no new or important weapons, customs or myths, have been found. The value of this excellent contribution to our knowledge of the Australians lies in the fact that it will strengthen and confirm our views, which have hitherto been based on insufficient data, concerning their position in the great family circle of human beings; and by all who wish to promote the true interests of science this will be as much appreciated as would have been a series of startling novelties. The evidence that is now before us points to the conclusion that the Australians have sprung from a primitive stock, less primitive perhaps than that which gave rise to the Tasmanians, Andamanese, and other curly headed negroid races, but more primitive than that which gave rise to other races of mankind. It seems that having taken some steps in advance they finally began to degenerate socially.

As regards their primitive anatomical features, the three skulls and one skeleton described in this volume, do not afford us a good basis for further generalisation; but it may be noted that in the two skulls fully described, the cranial capacity is well under 1,300 cc. and there is marked dolichocephalism. At the same time there is not the pronounced prognathism that we find in some savage races, both skulls being in this respect close to the boundary line between prognathism and mesognathism. This valuable little scrap of anatomical knowledge indicates, then, that the Central Australian strikingly approximates to what we have from previous knowledge considered to be the average of Australian characters.

Turning now to other anthropological features, we find that the Central Australian's weapons are very largely composed of wood. Wooden spears and shields, throwing-sticks, and boomerangs are his characteristic weapons. Metals were unknown to him until the time came when European travellers left meat tins behind them. He can chip stones and even porcelain telegraph insulators and fashion them into rough knives and spear heads; but, as in the case of the Tasmanian and Palaeolithic man, the idea of polishing stones or grinding them to a smooth even blade has never occurred to him.

The Australian is, however, a step in advance of his late Tasmanian neighbour in the matter of weapons. He can not only firmly fix his rough stone blades to sticks by means of resin and sinews; but he has invented two characteristic weapons,—the throwing-stick and the boomerang. Professor Stirling's statement that the Central Australian does not expect or intend the boomerang to return to him when he throws it, will be of interest to those who have tried in vain to demonstrate the action of this weapon with specimens taken at random from a museum.

To many anthropologists the most interesting portions of this volume will be those which deal with the social customs, beliefs and mental traits of the tribes visited by the expedition; for in them we find evidences of a past in the history of the Australian black about which there must still remain much doubt and uncertainty. It is a matter of regret that one who is so competent to form opinions as Prof. Stirling in matters anthropological, should be so modest in expressing them; but, after attempting to read between the lines, we cannot help feeling that Prof. Stirling must share the view that socially the Australian has considerably degenerated.

Mr. Gillen states in his account of the Arunta tribe that there is no belief in a devil, and this is almost the only reference in the volume to beliefs in spiritual beings. Several customs, however, which exist among many tribes of Australians besides those of the Central regions, indicate that formerly the belief in devils and spirits must have been prevalent. The cutting of the hair, the various mutilations of the body, and more particularly the practice of knocking out the incisor teeth are, in all probability, customs associated with

former superstitions which are now lost and forgotten. In his masterly essay entitled "Over de Mutilatie der Tanden etc," the late Dr. Wilken showed that among the Malay races the breaking and filing of the teeth originated as an exorcism of an evil spirit, although in many races at the present day the original meaning of the custom has been forgotten. Again, the widely distributed hair-myth shows itself in the girdle of human hair worn by the Australian warrior who believes that it imparts strength, courage, and accuracy of aim to the wearer. It is difficult to believe that this myth could have arisen independently in a race of savages who did not believe even in one devil. The white paint with which the Australian savages and other dark-skinned races of mankind daub themselves when they mourn the loss of a relative was in all probability, as Mr. Frazer and others have suggested, merely a disguise used to confound the returning ghost of the departed.

The peculiar marriage customs of the Australians also point to degeneration. The marriage of the Australian is what Maclennan called from an Arabic word a "Deega" marriage; that is to say, the man takes his wife to his own camp. Moreover, polygamy occurs, and occasionally at any rate a man captures by force a wife, belonging of course to a proper sub-phratry, from a neighbouring tribe; but associated with these patriarchal customs we have the fact that the child of the marriage belongs to the phratry of the mother and the man may never on any pretence speak to or look upon his wife's mother. The marriage customs then show at least a change from a more primitive matriarchy to a mild form of patriarchy.

The rude art, and the songs at the corroborrees also show that important changes in their history have taken place. The very valuable series of drawings copied from inscriptions found at Ayers rock and elsewhere by members of the expedition, are but conventional signs of which, in many cases, the meaning could not even be guessed. What, it might be asked, was the character of the original drawings from which these signs have been derived? The modern Australian cannot draw like his neighbour the Papuan savage, but, in all probability, his ancestors could, and the art has been to a great extent lost. As regards the songs too, surely they must have had a meaning in bygone times. Is it not at least probable that they were formerly of the nature of incantations or exorcisms, and that their significance has been lost with the ghostly beings to whom they were addressed, and that they remain now merely as formalities?

It might perhaps be urged that, as changes similar to those referred to have also occurred in the history of more civilised races, they ought not to be spoken of as signs of degeneration. Standing by themselves they are not; but it seems to be a peculiarity of the Australian race that no indigenous lines of progress have been made, and the resultant of the changes has been a loss of the principal features of social organisation. And where, it may be asked, are

there signs of recent progress? Even in counting the Australian has advanced no further than the number four.

It might be asked why the Australians should remain as the only large race of human beings in the world, occupying a continental island of great area, which shows but little signs of progress since palæolithic times? It seems possible that in bygone days when the Australian continent was, as the expedition proves, a well-watered and fertile land, the human race which inhabited it was progressing on lines comparable to those of the Negroes, American Indians, or even Papuans; but the gradual desiccation of the land in Quaternary times led to splitting up of large social communities and consequently to degeneracy as regards social organisation.

It is only the possibility of living in large communities that has allowed the development of arts and war and social organisation towards a high standard; and races that are obliged, from the nature of their land, to live in small groups to obtain the necessary food for mere existence, must have stood still or gradually degenerated.

Before bringing this notice to a conclusion mention must be made of the very important series of gesture signs that are given. They form a most interesting and valuable chapter in the science of gesture language and will be extremely useful to many students of anthropology.

SUMMARY.

SIXTY pages of Part I. are devoted to an abstract of the results of the Expedition and a statement of some conclusions to which they lead. The Summary we have already attempted to summarise, but this is almost impossible in the case of the chapter entitled "General Conclusions" so concise is it already. It consists of a masterly and suggestive discussion of the origin and relations of the present flora and fauna of Central Australia from a geological as well as a biological point of view. The conclusion at which the author arrives, is that the three sub-regions (Euronotian, Autochthonian and Eremian), into which Prof. Tate divided Australia on botanical grounds, must be modified and replaced by another division into three as follows:—

(1). TORRESIAN, including Papua and north and north-eastern Australia as far south as the Clarence River.

(2). BASSIAN, including the eastern and south-eastern coastal strip, lying between the coast-line and the Dividing Range south of the Clarence River, and also Tasmania.

(3). EYREAN, including the whole of the interior, southern and western part of the continent.

In conclusion, it only remains for us to congratulate Prof. Spencer on the manner in which he has seen these beautifully printed and illustrated volumes through the press. Mr. Horn may justly feel proud of them, for they are the crown and fruition of a work to which he must have devoted not merely treasure, but much anxious thought and consideration.

595.2

V.

Are the Arthropoda a Natural Group?

A NATURAL group from the stand-point of genealogical zoology is a group the branches of which all start from a common stem or ancestral stock which, while giving rise to them, grouped and connected at their origin with one another, gives rise to no other line of descent.

The Arthropoda appear to me to form such a natural group. Their ancestral stock, the Pro-Arthropoda, joins with the ancestral stocks of the Chætopoda and Rotifera, forming the large natural group of the Appendiculata. I urged this connection and proposed the term Appendiculata in 1878 in the preface to the English edition of Gegenbaur's Elements of Comparative Anatomy. At that time German zoologists placed the Chætopoda in the group Vermes and cut them off from all association with the Arthropoda. Huxley on the other hand had adopted Macleay's term Annulosa for a group including Chætopoda and Arthropoda but excluding Rotifera.

By associating the Chætopoda with the Arthropoda the parapodia of the former were identified with the appendages of the latter, and it became necessary to interpret the head of the arthropod in relation to the prostomium and peristomium of the chætopod.

I suggested in 1872 that "the ophthalmic segment alone in Arthropoda represents the prostomium [of Chætopoda], the antennary and antennular segments being aboriginally metastomial and only prostomial by later adaptational shifting of the oral aperture."

Moseley's discovery soon after this of the parapodial nature of the jaws of *Peripatus*, and the later discovery of the paired nephridia in every segment of its body, strengthened the hypothesis of a genetic connection between chætopods and arthropods.

In 1881 my study of *Limulus*, *Scorpio*, and *Apus* led me to the view that the prostomial antennæ of the chætopod are retained by *Peripatus*, the Myriopoda, and Hexapoda, but have been entirely lost by Crustacea and Arachnida, whence I proposed to call the former group Ceratophora and the latter Acerata.

The latest results of embryological investigation have shown that this view is probably incorrect, and according to Professors Korschelt and Heider a large and important application of my theory of the

passage of metastomial parapodia into association with the prostomium (and therefore a præoral position) is what with all reserve and caution they hold to afford the best explanation of the facts at present known. It appears that the antennæ of *Peripatus* and the antennæ of myriopods and hexapods as well as the two pairs present in Crustacea are all of them post-oral parapodia shifted in relation to the mouth. No adult arthropod retains the prostomial antennæ of the chætopod, but Korschelt and Heider suggest that the strange pair of small processes seen in embryo *Peripatus* in front of the head are these prostomial antennæ in a transient condition, whilst they are also represented (as I have myself long since taught) by the frontal tentacles of certain crustacean Nauplii (Cirripedes). The prostomial eyes of the chætopod appear (?) to be retained by *Peripatus*, but the eyes of all other Arthropoda are a new structure, and it is not impossible that they may after all represent (*cf.* Herbst's experiments on regeneration of crustacean eye as an antenniform palp) a pair of fore-shifted parapodial appendages.

The conclusion to which embryological study (as to segments of body-cavity, so-called cerebral ganglion, and position of early rudiments of antennary appendages of arthropods) tends, is that in the various branches of arthropod descent from the ancestral Pro-Arthropoda there have been forward movements or shiftings of post-oral segments and their parapodia (possibly to the number of three in some cases and of less in other cases), so that the mandible of *Peripatus* does not belong to the same ancestral segment as does the mandible of the insect and crustacean, whilst the cephalic appendages of the Arachnida require a separate interpretation. (*cf.* Korschelt and Heider, "Vergleich. Entwickelungsgesch." p. 906). The development of my original doctrine of prostomiad shifting or attraction of post-oral segments and their appendages to the prostomium has indeed now assumed very serious proportions. It will require renewed researches both upon the developmental history of the chætopod prostomium and that of the head in various Arthropoda, before precise and definite conclusions in the matter can be formulated.

In the meantime I am none the less unable to agree with those who doubt that the Arthropoda form a natural group in the sense indicated above.

There are two remarkable and independent characters possessed by all Arthropoda, including *Peripatus*, which we must suppose either to have been independently acquired by the different lines of descent now united under the name Arthropoda—or to have been inherited by all Arthropoda from common ancestors—the Pro-arthropoda. These two characters are (1) the modification of one or more pairs of post-oral parapodia to serve as opposable nipper-like jaws (hence the term GNATHOPODA which I formerly suggested as more appropriate than ARTHROPODA for the designation of the group); (2) the peculiar condition of the great dorsal heart, which may be termed 'ostiate.' The Arthropod heart is a contractile tube, lying in a pericardial

blood-sinus formed by the fusion of the veins whose walls have disappeared, leaving their openings into the heart itself as naked 'ostia.' (The theoretical explanation of the derivation of the arthropod heart from a median dorsal vessel fed by paired lateral veins was given in my article on the "Cœlom and Vascular System of Mollusca and Arthropoda," *Quart. Journ. Micr. Sci.*, vol. xxxiv., 1893).

The parapodial jaws and the ostiate heart cannot be supposed to have been *both* developed independently in each group of arthropods, or in any two of them. That is a supposition which seems to me, in our present state of knowledge as to "homoplastic structures," inadmissible. Hence I conclude that they were inherited from a common ancestral stock, in which they arose (since we find them nowhere outside the Arthropoda), and the derivation of all the Arthropoda from this one stock which had already acquired two great distinctive characters of all known Arthropoda, renders it impossible —without some new and unrecognised use of language—to speak of the Arthropoda as constituting more than one natural group.

On all hands it is admitted that this group comprises (as most large groups do) several diverging lines of descent.

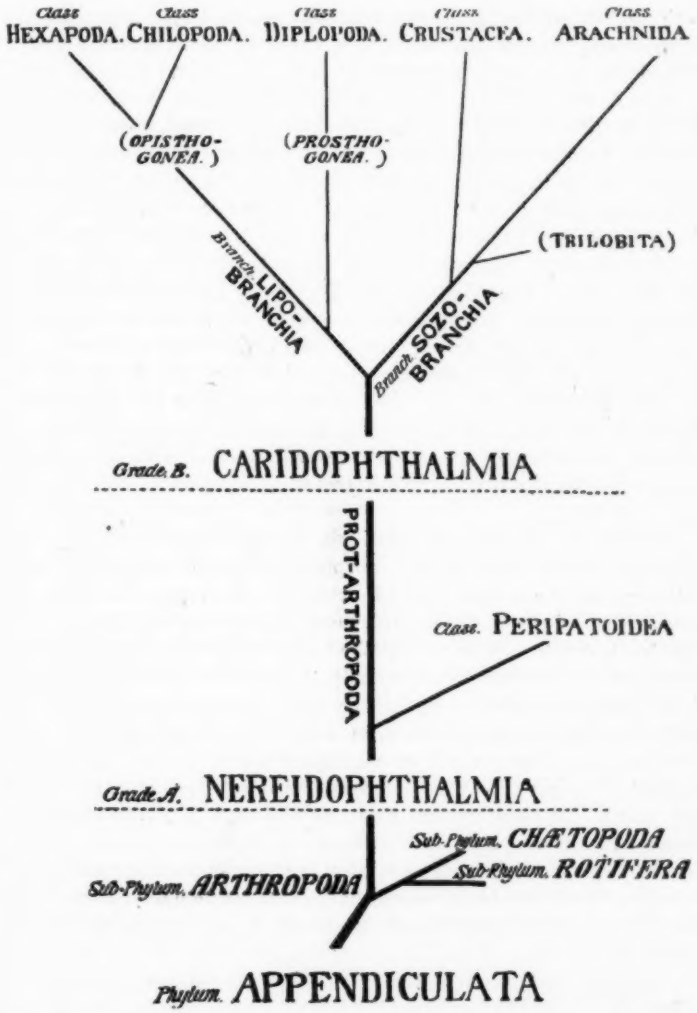
The conception which I have formed, from the facts now ascertained, as to the relationships of those groups is indicated by the subjoined diagram. I do not introduce the pycnogonids or other degenerate groups into consideration.

I regard the trilobites as a lower ancestral grade of the Arachnida, possessing the parapodial antennæ which the higher grade have lost, and I propose to distinguish these grades as *Arachnida eucerata* and *Arachnida lipocerata*. The trilobites exhibit the same wide range in the number of body-segments which is observed in the lower Crustacea, whereas the most fully-developed Arachnida (Eurypterines, *Limulus*, and *Scorpio*) present eighteen segments arranged in three sets of six. The immediate ancestors of the trilobites and those of the Crustacea were probably more closely allied than were either to the ancestry of hexapods, chilopods, and diplopods, but it must be remembered that the common ancestor of trilobites and *Apus* could not be reckoned a crustacean, since it probably had only one and not two pairs of præoral tactile appendages.

In any scheme of Arthropod classification we have to admit the occurrence of remarkable instances of homoplastic agreement—that is to say, we cannot conceive of the derivation of the classes in such a way as to assign to certain important and remarkably elaborated organs a single point of origin. The facetted eyes of Insecta and Crustacea are examples—also the tracheæ of *Peripatus*, Diplopoda, Chilopoda, Hexapoda, and certain Arachnida—and again the enteric cœcal tubes of Amphipoda and of scorpions, which so much resemble but differ in origin from the proctodœal malpighian tubes of Hexapoda.

There are, no doubt, besides the two great characters which I

have cited as holding the Arthropoda together, others which have universal validity and importance, if we except the Peripatoidea. These characters are not in any way difficult to suppose as later developments of conditions already realised in the lower grade repre-



sented by *Peripatus*. Such are the plating and jointing of the body and limbs with dense chitin. *Peripatus* has a soft extensile body, but dense chitin is already deposited on its jaws and claws. It, however, does not actually possess "arthropodous" limbs. Striated muscle and absence of ciliated epithelium go with the increased deposit of

cuticular chitin. Due weight was given by some, at least, of the recent writers in this journal to the reduction of the cœlom and the swelling out of the blood spaces as an Arthropod character—a character to which the 'ostiate' condition of the heart is clearly related, and one which I believe I was the first to point out, together with the related derivation of the tubular gonads from nephridia and perigonadial cœlomic remnants (*cf.* my note on Mr. Gulland's paper, "Evidence in favour of the view that the coxal gland of *Limulus* and of other Arachnida is a modified nephridium," *Quart. Journ. Micr. Sci.*, vol. xxv., 1885, p. 515). It is, however, to be noted, that a similar (but not identical) reduction of cœlom and enlargement of blood-spaces occurs in Mollusca—and that if we take it alone, without associating with it the resulting ostiate character of the heart, this character is not distinctive of Arthropoda. It is interesting to recall in this connection what was the most advanced teaching twenty years ago, viz., that of Carl Gegenbaur. He states ("Elements of Comparative Anatomy," English edition, 1878, p. 278) that the cœlom is found in all the Arthropoda and "forms a portion of the blood-vascular system, so that the peri-enteric fluid found in many Vermes as a fluid different from the blood, is represented in the Arthropoda by the blood itself." And similarly in the chapter on the cœlom of mollusca we find (p. 367), "As a rule, the vascular system is freely connected with the cœlom, which therefore forms a portion of the hæmal system."

I think that it must be admitted that an important change has been made in our views of the morphology both of Arthropoda and Mollusca by the result arrived at some years ago through my investigation of the cœlomic and vascular systems of Mollusca and Arthropoda (confirmed and established in the latter case by Sedgwick's researches on *Peripatus* development), though that change is not so widely recognised abroad as in England. Even that most distinguished anatomist, Kowalewsky, in a recent valuable memoir, still calls the ventral blood-sinus of a hexapod insect its cœlom. Many morphologists, both in England and Germany, now recognise that both cœlom and blood-system exist in Mollusca and Arthropoda as distinct systems of spaces shut off from one another, the cœlom being reduced to perigonadial, epi-nephridial, and (in Mollusca) pericardial remnants, whilst the blood-vessels have swollen and united to form an extensive series of blood-sinuses, to which I have given the name "hæmocœl."

Oxford. E. Ray Lankester.

SOME NEW BOOKS.

Nansen's Book.

Farthest North, by Fridtjof Nansen, being the record of a voyage of exploration of the ship *Fram* 1893–1896 and of a fifteen months' sleigh journey by Dr. Nansen and Lieut. Johansen, with an appendix by Otto Sverdrup captain of the *Fram*. Two vols., 8vo. Pp. xvi., 510 and xvi., 672, with 16 coloured plates, 4 folding maps, etched portrait frontispiece, and numerous full-page and text illustrations. Westminster: Archibald Constable & Co., 1897. Price 42s.

Not the telegrams, nor the lectures, nor even the *Daily Chronicle* articles have spoilt our appetite for this vividly written and admirably illustrated account of one of the most remarkable voyages of exploration that the world has yet seen. It is not the results, or the adventures, or the literary style that make the most forcible appeal to all of us; but it is the fulfilment step by step of a plan boldly yet deeply laid, and worked out with a combination of intellectual sagacity and the utmost physical bravery. The sagas of Eric the Red and Leif the Lucky speak of the childhood of the world, but this new Fridtjof's Saga is a tale of its manhood—mind and body striving in full accord towards one definite goal. And so its method as well as its object have interest for men of science most of all: the object, no sensational dash for the pole, but "to investigate the great unknown region that surrounds it"; the method, based from beginning to end, in every item, on observation and experiment. "It is," writes Nansen, when preparing for his sledge expedition, "on the felicitous combination of trifles that ultimate success depends," and the striking success of the whole was due to the most rigorous adherence to this maxim.

The book consists of the following parts. A recapitulation of the scientific basis of the plan, largely reprinted from Nansen's address to the Geographical Society of Christiania; a short account of the preparations, including a description of the "Fram"; the voyage along the north coast of the old world, in which is intercalated the interesting narrative of Alexander Trontheim's journey with the dogs through the Urals and the tundras to meet the ship at Khabarova; the entry into the ice and the freezing in and drifting of the "Fram" to longitude 110° E, in November, 1894 (end of vol. i.); the preparations for the sledge-expedition; the expedition by Nansen and Johansen; their winter (1895–96) in Franz Josef Land, and journey S.W., till the meeting with Jackson; return in the "Windward"; Captain Sverdrup's account of the voyage of the "Fram" after the departure of Nansen and Johansen, occupying 112 pages; conclusion, giving a few main results of the expedition, by Nansen; a good Index. A large part of the book consists of excerpts from Nansen's diaries, so that we follow his varying feelings from day to day, and despite monotonous surroundings neither variety nor vivacity are wanting to the narrative. We are plunged from rhapsodies on the Northern Lights into the excitement of a bear-hunt, or recalled from

meditations on eternity and the vanity of our mortal aims to the consideration of a toothsome bill of fare. One can skip the rhapsodies, but they have their place as throwing light on the psychology of the Arctic explorer; we note that they recur less often after the comfort of the "Fram" has been left. However, we do not propose to review the book from the journalist's standpoint, and shall merely direct attention to a few details of scientific interest.

Meteorological observations, under the direction of Lieut. Scott-Hansen, "were taken every four hours day and night; indeed, for a considerable part of the time, every two hours." "Hansen had also at stated periods to take observations to determine the magnetic constant." The salinity and temperature of the water at different depths were also observed; the amount of electricity in the air ascertained; marine currents were investigated: all this fell to the lot of Nansen. The aurora was regularly observed, first by Nansen, then by Dr. Blessing. Sounding and dredging were constant, and gave occupation to all hands.

Temperature-observations showed that under the cold surface was more saline and warmer water with a temperature sometimes as high as 1° C. Ascribing this to the diving of the Gulf Stream, Nansen speaks of the fact as "surprising" and as modifying theories hitherto entertained. As a matter of fact it does nothing more than confirm the observations of Scoresby, Markham, and Maury, and the views of Lyell, Croll, and other people not unknown.

In connection with the surface layer of fresh water, some curious statements are made on pp. 174, 177 of vol. i. Off Taimur Id. "we could hardly get on at all for the dead-water, and we swept the whole sea along with us. . . . Where a surface layer of fresh water rests upon the salt water of the sea . . . this fresh water is carried along with the ship, gliding on the heavier sea beneath. While we had drinking water on the surface the water we got from the bottom cock of the engine-room was too salt to be used for the boiler. Dead-water manifests itself in the form of larger or smaller ripples or waves stretching across the wake, the one behind the other, arising sometimes as far forward as almost amidships." This appears to have taken away all the momentum of the vessel. But at last "some thin ice scraped the dead water off us. The change was noticeable at once. As the *Fram* cut into the ice crust she gave a sort of spring forward, and, after this, went on at her ordinary speed." To our landlubber mind this sounds like some old *Remora*-superstition, and sadly demands explanation.

Basing his whole plan on the drift of the ice, it is natural that Nansen should have devoted much attention to this phenomenon. The successful issue of the voyage is itself a proof of the reality of the drift, but there were also material evidences in the shape of logs of Siberian larch, observed by Nansen on his sledge expedition, and by Sverdrup on the "Fram" (vol. ii., pp. 153, 580). Further, river-ice with clay and gravel was seen in lat. 85° N and about 90° E. This drift of the ice is due to the prevailing winds, but there is also "a slow current in the water under the ice, travelling in the same direction." Thus not only Nansen's previous conclusions, but also the views of A. E. Nordenskiöld as to the currents in the Kara Sea, are confirmed, while the greater thickness of the ice north of the Atlantic over that north of Siberia receives a simple explanation.

There are some valuable observations on the formation of polar ice (vol. i., p. 404). Ice formed in autumn continues to increase up till next midsummer, but more slowly with increase of thickness.

When the snow melts in summer, the fresh water is cooled down as it comes in contact with the cold salt water, and at the junction of the two a layer of ice is formed, and gradually becomes attached to the bottom of the old ice. The complication in the structure of the ice is further increasing by the pressure producing overthrusts, and so increasing the thickness of the floes enormously. Naturally the older floes are the thicker; and the older are those that have drifted further to the west.

North of Siberia a regular alternation of ice-pressure coinciding with the tides was noticed; but further west this cause did not seem to operate, and pressure here was due to the winds. The pressure-ridges have a regular direction at right angles to the lines of force. These observations chiefly confirm those made by the "Jeannette." Hummocks very rarely exceed 23 feet in height (above sea-level?); those said to attain 50 feet are either bits of icebergs or creatures of the imagination.

It is needless here to say more as to the great depths in the polar sea found by this expedition. It does not all appear to have been so deep, but the statements are not very precise. The only bottom samples mentioned were obtained in about 82° 50′ N., 115° E (exact position nowhere stated) and consisted of "a layer of grey clay 4 to 4½ inches thick, and below that brown clay or mud." This was at 800 fms. Two pails of mud dredged up a few days later contained "chiefly starfish, waving starfish, medusae (*astrophyton*), sea-slugs, coral insects (*alcyonariae*), worms, sponges, shell-fish, and crustaceans." This very peculiar list conveys little to one's mind, and it does not convey the idea of great depth. The bottom-temperature here was probably, as before, +0.18° C.; but neither depth nor temperature are given. The necton about here, at a depth of 27 fms., contained many "small crustaceans (*kopepodae*, *ostrakodae*, *amphipodae*, etc.) and a little Arctic worm (*spadella*) that swims about in the sea." The only other similar statement is that shortly before reaching Franz Josef Land, Nansen caught in the net "a pteropod (*Clio borealis*) and a few crustacea."

The ice itself yielded many organisms of great interest apparently, though we are told little about them:—Diatoms, algae, and floating in the pools "a number of small viscid lumps, some white, some of a yellowish-red colour" (perhaps some kind of Proteomyxa or Labyrinthulia). All these seem to float at the junction of the fresh-water layer with the salt water. The dark colour of these organisms, absorbing the sun's rays, helps to melt the ice and so form the pools in which they live. In the pools were also Infusoria, Flagellata, and Bacteria.

Much attention has already been directed to the quantities of Ross's gull that were observed; it appears to breed in the N.E. parts of Franz Josef Land. It was first observed in August, at about 84° N., 80° E. About this time and place several birds were seen, of which the names are given as follows: "*Larus eburneus*, *L. glaucus*, *L. argentatus?* [?], *Rissa tridactyla*, *Procellaria glacialis*, *Uria grylle*, a skua, and a snow bunting." *Procellaria glacialis* was also seen the first of any birds on the return sledge journey, May 25, 1895, about 82° 50′ N., 70° E. On June 18 of the same year Brünnich's guillemot appeared, and two days later, with a west wind, numbers of little auks. The most northerly mammal observed was a fox, or rather his tracks, on April 26, at about 85° N. Next came narwhals on May 19, in about 82° N. *Phoca barbata* was not seen till another month and another degree of latitude had been passed.

On August 15, on Houen Id., in the N.E. part of Franz Josef land, *Papaver nudicaule*, *Saxifraga nivalis*, and a *Stellaria* were found in bloom.

Scattered through the book are some observations of geological interest. There are signs of former glaciation on the coast of Siberia, even where the land lies very low. The mountains about C. Chelyuskin are flat-topped with precipitous sides; the rock appears to be sandstone or basalt. In various parts of Franz Josef Land, as on Spitzbergen, are numerous raised beach-lines, often with shells, cetacean bones, and other evidences of the comparatively recent elevation of the land. The most important point, however, is the determination of the age of the sedimentary rocks of Franz Josef Land, and also of the interbedded basalt. Certain plant-remains collected by Johansen, though the locality was originally noted by Mr. Jackson and Dr. Koetlitz, were submitted to Professor Nathorst, who considers without doubt that the remains are of Upper Jurassic age, and that like the contemporary flora of Spitzbergen they do not indicate a particularly genial climate, although enormously more so than that of to-day. A new species, *Gingko polaris*, is figured.

But we must leave this important discovery in order to consider some geographical questions. And here we cannot affect to pass without censure the unfortunate accident of the stopping of the chronometers of both Johansen and Nansen. It is an explorer's first duty to himself and to the world in general to be sure of his positions, but this is impossible if, like any ordinary mortal, he forgets to wind up his watch. On Tuesday, April 2nd, 1895, "when we finally came to a standstill we had been on the move so long that it was too late to wind up our watches. Johansen's had stopped altogether; mine was ticking, and happily still going when I wound it up, so I hope that it is all right." This might have been a warning, and yet on Friday, April 12th, for precisely the same reason, "we had the misfortune to let our watches run down." Of course it was possible to set the watches again approximately, and the necessary corrections could be, and were, made when civilisation was again reached. But the consequence of all this has been a good deal of unnecessary trouble to the explorers and to others. As, however, certain statements have been made tending to suggest that Nansen was 12 or 13 degrees out in his longitude, it is important to note that his error was only 6½ degrees. Moreover, he distinctly states that a part of this error was intentional; he assumed a more westerly longitude than he believed himself to be in, so as to obviate all chance of over-shooting Franz Josef Land. It is clear from his subsequent narrative that it was not the slight error in longitude that threw him out, but the non-existence of the Dove Glacier; when he got to the region explored by Leigh Smith, he recognised his position plainly.

It is perhaps due partly to the error in longitude, partly to the fact that he entered Franz Josef Land from its least explored N.E. end, that led Nansen to over much criticism of Payer, and that led him further to imitate Mr. Jackson, who, we are told by his friend and mouthpiece, "has been forced to ignore or condemn the statements of Payer." Perhaps, too, gratitude for his hospitality induced Nansen to accept Mr. Jackson's criticisms too readily. We do not know how else to account for some strange items on his map of Franz Josef Land. South of Hohenlohe Id., Payer marks a group of five small islands, to the largest of which he gives the name Coburg Id.; Nansen calls this Torup Id., restricting the name Coburg to an insignificant rock. Between Coburg and Rainer Islands, in 81° 30′ N., Payer has

placed Andrée Id. Nansen has shown Rainer Id. to consist of two islands; to the smaller westerly portion he gives the name of Leigh Smith, to which no exception can be taken, but he alters Andrée Id. to Karl Alexander Land. Payer was never actually on the land which he named Karl Alexander, so that its position on his chart is only approximate; it appears as a large mass of land between 56° and 58° E. longitude, and 81° 20′ and 81° 30′ N. This position is occupied on Nansen's map by an irregularly shaped island called Frederick Jackson Id.; this then should be called Karl Alexander Land, and south, not north, of it should be Back's Inlet. Between Back's Inlet and Todesco Fjord comes the island that bears Capes McClintock and Fisher. South of Todesco Fjord, which now proves to be a sound, lies the land with Richthofen Peak, C. Fiume, and C. Triest. Lastly, south of an easterly extension from the great Markham Sound, comes the group of islands which Payer, standing on their eastern edge and looking across their flat tops, lumped together as "Mac-Clintock Island?" Thus, and thus only it seems to us can one attain harmony between the pioneer work of Payer and the more detailed work of Leigh Smith, Jackson, and Nansen. Why should not harmony be attained? Why "ignore" Payer?

Next, as to the name Zichy Land. Payer's map shows us, on the east Wilczek Land, on the west Zichy Land, and between the two an archipelago. Standing on the high ground (over 2500 feet) on the east shore of McClintock Island, he looked westward over a number of islands, of which the most important are now distinguished as Brady, Hooker and Fridtjof Nansen, and naturally was unable to see the narrow sounds between them. But west of all these he saw a long and broad sound, running N.E. and S.W., and beyond it the distinct coast-line of a land mass. The sound he called Markham Sound; the land he called Zichy Land. Leigh Smith, who followed, recognised this, and in his second map *(Proc. R. Geog. Soc.* 1883, facing p. 248), the name Zichy Land is assigned to the land due north of Northbrook, Bruce, Mabel, and Bell Islands. The land further west of this was called by him Alexandra Land. It is the land that bears, among other things, the Gratton Glacier, to which Payer and Leigh Smith applied the name Zichy Land. But on Nansen's map that name is removed from that land and stretched over the chain of islands to which Payer most certainly did not apply it. Similarly, in accordance with Mr. Jackson's views, the name Markham Sound is restricted to the small easterly portion of the original sound.

Now we do not stand alone in holding these opinions; but even supposing that we are ultimately shown to be wrong, surely it would have been better that Messrs. Jackson, Nansen, and Co., should have waited until their survey was completed before peppering the country with new names, so that they might have instituted a more exact comparison of their own maps with those of Payer and Leigh Smith, taking into their councils those eminent explorers, who are happily still with us. This would have been better than "to ignore or condemn" them unheard.

Just a word as to the translation. On the whole it is admirable, so good indeed that some credit might have been given by the publishers where credit was due. Some thanks, we have heard, is owing to our learned Ibsen-translator, Mr. William Archer. None the less there are a few slips; it is strange to read (ii, 605) of "10 prismer, or 330 grammes, of gun-cotton," as though "prism" was the Norwegian for 33 grammes, and not a common English word. Then

we find certain stratified sandstones alluded to as "schist" (i, 189), doubtless a mistranslation of "skiffer." The word "steinen," the stone, is translated as "Rocks." The Norwegian "strand-linie," should be "beach-line." "Snails" (II. 308) should be "gastropods." As for the zoology, the extracts we have given show that the proofs were read by no scientific Englishman, probably not even by the author. There are a few discrepancies in the spelling of proper names between Nansen and Mr. Montefiore Brice; the Johansen, Koetlitz, and Blomqvist of the former are the Johannesen, Kettlitz, and Blomvist of the latter.

The illustrations deserve more praise than we have space for. It is so nice to feel that they are all from photographs and must be so truthful. And yet—well, who was the photographer Nansen and Johansen went to when they were alone on their sledging journey?

WELWITSCH'S AFRICAN PLANTS.

CATALOGUE OF THE AFRICAN PLANTS COLLECTED BY DR. FRIEDRICH WELWITSCH IN 1853–61. Dicotyledons, Part I. By W. P. Hiern. British Museum (Natural History). Printed by order of the Trustees. Pp. 336. London, 1896. Price 7s. 6d.

FRIEDRICH WELWITSCH was born in 1806. His father, the owner of a large farm in Carinthia, sent him to study law at Vienna University. His own tastes, however, were so strongly botanical that in consequence of his abandoning law for flowers his father withdrew his allowance. He then supported himself at the University for a time by writing dramatic criticisms, until, as the biography prefixed to this catalogue tells us, an "act of youthful indiscretion on his part, in the course of enjoying too freely the gaieties of Vienna, rendered it expedient for him to leave Austria for a time." After some excellent work in Portugal, he left, in 1853, on his great Angolan journey, probably the most fruitful African expedition ever made by a botanist. He explored and thoroughly searched most of Angola and Benguella during eight years, suffering great hardships and frequently prostrated by fever, dysentery, and other African maladies. On one occasion he was besieged for two months by some 15,000 rebellious natives. Finally, he sailed for Lisbon with his great collection, contained in 42 huge packages occupying about 319 cubic feet. This consisted of some 5,000 species of plants and 3,000 specimens of insects and animals. The number of new forms, including the unique *Welwitschia*, was extraordinary. After this it is not pleasant to read of his poverty, ill-health, and death in London, where he stayed in order to work over his collections with but small support from the Portuguese Government. After his death in 1872, that government attempted, by a suit in Chancery, to obtain the whole of his collections; but Messrs. W. Carruthers and F. Justen, who defended at their own risk, were successful in retaining the best set (after the study set) for the British Museum.

We are now presented with the first instalment of a complete catalogue of that collection so happily preserved, and it begins appropriately with a portrait of Welwitsch, and a complete bibliography, not merely of the author's own papers, but of others dealing more or less directly with his collections. This volume, which has been carefully prepared, well printed, and handsomely bound, covers the Thalamifloræ and the Leguminosæ as far as the order Rhizophoraceæ. Would it not have been better to have begun at the other end of the flora? More valuable and novel results would

certainly have been obtained from the Monocotyledons and Incompletæ; for the orders now dealt with have been entirely covered by the first two volumes of "The Flora of Tropical Africa." This being so, we are surprised to find two genera and 60 species here described for the first time, rather than disappointed at the smallness of the number. Each order is prefaced by an account of its distribution in Angola, with mention of its more interesting species. The details concerning the latter, though based almost entirely on Welwitsch's notes, derive great value from the many years spent by that botanist in Angola and from the earnest study he made of the country.

The new genera, *Epinetrum* in Menispermaceæ and *Zanha* in Burseraceæ, are described entirely from male flowers, the fruits and female flowers being unknown. A sign of the times, and a feature that will be welcomed by many, is the use of the English language instead of the Latin for the description of all novelties. It is true that such unusual phrases as "strict branches," "depresso-hemispherical discs," and "quasi-sheathing scales," are neither elegant, nor English, nor more intelligible; but in the notes an occasional sentence is more attractive. Thus, we read of plants, "decked in all parts with a silvery lustre," and fruits "which glow with the brightest scarlet red."

Much valuable information as to dyes, timber, medicines, and economic plants generally is to be found in this volume—though not too easily, for there is no index to native or economic names. This addition, which might be made in a future volume, ought to render the work of service to practical men.

Great pains have been taken with the synonymy. Apparently the names of over 160 genera, many of them familiar to us in the "Genera Plantarum" and in "The Flora of Tropical Africa," have been replaced by previously given but unfamiliar and often less euphonious names. Thus, instead of the well-known *Cola*, *Smithia*, and *Swietenia*, one finds *Edwardia*, *Damapana*, and *Entlandrophragma*. Mr Hiern's extreme conscientiousness in these matters is shown by his use of *Annona* for *Anona*, *Cajan* for *Cajanus*, *Sesban* for *Sesbania*, *Canavali* for *Canavalia*. For work of this kind we cannot profess gratitude. All this historical nomenclature changing might safely be left to those incapable of true botanical work. We are not surprised to learn that a protest against it has been raised by many German botanists. Finality, as experience of Dr. Otto Kuntze shows us, can hardly be hoped for; and yet that is more likely to be reached by someone prepared to write a new "Genera Plantarum," dealing with all the plants of the world, and not merely with those of what is at best but a small portion of Africa.

An Unnatural Union.

A Manual and Dictionary of the Flowering Plants and Ferns. By J. C. Willis, M.A. 8vo. Vol. i., pp. xiv., 224; vol. ii., pp. xiii., 429. Cambridge University Press. 1897. Price 10s.

This is the latest member of the biological series of the Cambridge Natural Science Manuals, and forms a useful addition to that series. The two volumes are practically two distinct books, and the recognition of this by issuing them as such would be beneficial to the botanical public, and also, we think, to the publishers. Vol. I., which was originally "intended only to be a kind of index to Part II.," ultimately developed into "what is practically a text-book of morphology, classification, natural history, and geographical distribution." The

chapter on morphology is unsatisfactory, and so far as the vegetative organs are concerned leaves the reader with very vague and incomplete ideas; the treatment of the flower, however, is good. Chapters II. and III., dealing with variation, classification, forms of vegetation, geographical distribution, etc., are useful, while the last chapter, "Economic Botany," is scarcely more than a list of plants, concerning which further information can be obtained by reference to Part II. As a text-book Part I. cannot be recommended, though the student will find in those portions to which we refer favourably a great deal that is useful and suggestive, and not to be found in the ordinary text-book. The introductory chapter contains under the head "Botanic Gardens, &c.," a brief outline of the contents of the gardens at Kew and Cambridge; and the student's attention is directed to some of the more note-worthy plants in the various houses and beds.

Vol. II. is quite a different book, and one of the most useful compilations ever offered to those interested in the science. It is a dictionary of "the classes, cohorts, orders and chief genera of phanerogams and ferns, alphabetically arranged under their Latin names." The accounts given of the larger divisions, including the more important natural orders, are full and concise, and the same may be said of those genera which are of common occurrence in cultivation, or of economic value, or of special interest to the morphologist or biologist. The author has drawn largely for his information upon Engler and Prantl's "Pflanzen-familien"; but numerous other works have been consulted, and the copious references to these will assist the enquirer to a more exhaustive knowledge. Considerable attention has been given to details of bionomic interest, such as pollination, the relations existing between the plants in question and insects, or devices for seed-distribution. The second volume ends with a "glossarial index of English names, technical terms, etc." The correlation of the English with the Latin name enables one to look up information about a plant of which one knows only the popular name. But it is a pity to burden the glossary with a reprint of the index of Part I.—another argument in favour of our suggestion of completely divorcing the two volumes.

By the use of small print, thin paper, and thin covers, both volumes are reduced to a small and handy size.

PHYSIOLOGY FOR MEDICALS.

KIRKES' HANDBOOK OF PHYSIOLOGY. Fourteenth Edition. By W. D. Halliburton, M.D., F.R.S., Professor of Physiology, King's College, London. 8vo. Pp. xvii., 851. London: John Murray, 1896. Price 14s.

IT is the necessary fate of a student's handbook which is successful enough to last for some fifty years to fall into the hands of a succession of editors. Written originally by Dr. Kirkes for medical students (largely, we believe, from Sir James Paget's lectures), and probably an excellent book for its time, it has required so much change and alteration with the advance of knowledge, that it may safely be averred that its original author would no longer recognise it. For many years the successive editions have been in medical or surgical hands, and though this has probably not detracted from its value to the medical student, it is certain that its value as a standard text-book of physiology will be increased now that it has fallen into the hands of a writer who is essentially a physiologist, and one so well known as Dr. Halliburton.

We have nothing but praise for the manner in which the author

has discharged his task. We say the author, and not the editor, for the book is to all intents and purposes a new one. Nevertheless, the essential character of the book has been admirably preserved, and in particular the special point which renders it of such utility to the medical student—the combination of histology with physiology. It is, indeed, written avowedly for the use of medical students, and it may safely be said that they could not easily find a work which so precisely fits their special needs, though at the same time it is a valuable general introduction to the subject for those who have other ends in view. There is, naturally, nothing here presented which is in itself novel: the book is well brought up to date, and that is sufficient. Criticism resolves itself into an examination of the facts selected for presentation to the student, and the mode and order of their presentment. Dr. Halliburton's experience as a teacher has enabled him to choose his facts judiciously and to present them clearly and concisely, and if one part of the book is better than another it is natural that it should be that which treats of physiological chemistry, the subject in which his name is best known. In the matter of arrangement the only doubt that arises in our minds is concerning the wisdom of presenting the student so early in the book with the difficult subjects of the physiology of the nervous system and special senses. The illustrations are profuse and excellent, and the size and compass of the work are such as to render it in every way convenient.

Scraps from Serials.

Apropos of our Note and Comment on the alternation of generations in plants, based upon Dr. Scott's address to the Botanical Section of the British Association last September, it is interesting to read in *Nature* for March 4, a paper by Sir Edward Fry on the alternations of generations in plant-life, and it is also startling to learn from a footnote that the MS. of this paper "reached the hands of the Editor of *Nature* on 31 August last year."

Mr. F. W. Sardeson has a paper on the Galena and Maquoketa series, running in the *American Geologist*. The second part, in the February number, is devoted to an exhaustive study of the well-known Ordovician and Silurian brachiopod *Orthis testudinaria*, the American forms of which are here split up into 9 species. It is hoped that this minute differentiation will throw light upon the stratification of the beds under discussion.

We are glad to see in the March number of *Knowledge* Mr. F. Enock's interesting account of the life-history of the common tiger-beetle, which he delivered before the Zoological Section at the Liverpool meeting of the British Association, a fact that is not stated by *Knowledge*. The same number contains an interesting article by Dr. H. R. Mill on the Victorian Era in Geography, illustrated by maps of Africa in 1837 and 1897.

The *American Journal of Science* for March contains the conclusion of Dr. Beecher's Classification of the Trilobites, with an index to the genera. R. S. Tarr writes on the Arctic sea-ice as a geological agent. He shows that sea-made ice protects the coast from marine erosion, quite as much as, if not more than, it acts itself as an eroding agent. The action of glacier ice is similarly two-fold. An enormous amount of detritus is carried southwards by the arctic marine and glacier ice. J. S. Diller describes and figures Crater Lake, Oregon; while Messrs. F. D. Adams, A. E. Barlow and R. W. Ells describe the Grenville and Hastings series in the Laurentian rocks of Canada.

Our animated contemporary, *La Revue Scientifique*, is instituting a reform in French orthography. We always imagined that the orthography of the French language had been settled once for all by the Academie Française. The *Revue*, however, has certainly laid its finger upon some weak points. It proposes in future to write "ph" as "f," and to change the "x" of the plural into "s," except in those cases where the singular noun itself ends in "x," but it does not feel that it has yet sufficient support for the changing of "y" into "i" in those cases where it has the equivalent sound.

Humanity for February contains a useful list of rare birds killed in Great Britain last year, compiled by J. Collinson.

From the Geological Institute of the University of Upsala, we have received vol ii. part 2, of its *Bulletin*. This contains Carl Wiman's valuable paper "Ueber die Graptoliten," the chief results of which were kindly summarised by him for the readers of NATURAL SCIENCE, September and October, 1896. An equally important paper in this volume is that by J. G. Andersson on the Cambrian and Silurian phosphoritic stones of Sweden. In this the distribution, relations, and origin of all phosphoritic nodules and beds is fully described and discussed on the evidence of personal observation in the field and laboratory. The illustrations are specially commendable.

A criticism of Mr. Andersson's paper, and a consideration of the occurrence of phosphorites generally, by Herman Hedström, has just appeared in the *Förhandlingar* of the Geological Society in Stockholm (vol. xviii., pp. 560 620).

The "Psychological Index" just issued by the *Psychological Review* is not only published in the *Année Psychologique*, where it will have the co-operation of N. Vaschide in the preparation of French titles, but has also entered into co-operation with the *Zeitschrift für Psychologie u. Physiologie der Sinnesorgane*, exchanging the titles of papers with that publication, and thus making both more complete.

The *Antananarivo Annual* is rapidly assuming importance as a scientific journal. No. 20, for Christmas, 1896, being pp. 385 to 512 of vol. v., contains numerous interesting articles, some of them, it is true, reprinted from other sources, some translated into English. The original ones are: "From Fort Dauphin to Fianarantsoa," by E. F. Knight; "Malagasy Plant-Names"; "Notes on some Madagascar Spiders and their protective Resemblances," and "The Mammals of Madagascar," by Rev. J. Sibree; some notes on Madagascar geology, by Rev. R. Baron; "The 'Mohara' or War-Charm of Imerina," and "By-gone Ornamentation and Dress among the Hova Malagasy," by Rev. W. J. Edmonds; "Ohabolana, or Wit and Wisdom of the Hova of Madagascar," by Rev. J. A. Houlder; "The Zanakantitra Tribe," by H. E. Clark; "A Native Malagasy Lyric," by Rev. W. F. Cousins; "A Taifasy Village," by Rev. C. Collins; "Lamhay, in North-East Madagascar," by H. Hanning. The London agents for the *Annual* are Messrs. John Haddon & Co., Salisbury Square.

NEW SERIALS.

WE have received the first number, issued on the 1st of March, of the *Revue Diplomatique et Coloniale, receuil bi-mensuel de politique extérieure*, published at the office of the *Revue Rose* and the *Revue Bleue*, 19, rue des St. Pères, Paris. The yearly subscription for the postal union is 12 francs 50. We presume that this review, though dealing chiefly with political questions, has been sent to us on account of its containing an article by Prof. Marcel Dubois, entitled "Science et Pro-

pagande." The propaganda, however, appear to be those of French colonisation rather than of science. The only other article that at all comes within our purview is that of the navigability of the Mekong, by J. B. d'Attanoux.

The *Open Court* (Chicago) has changed into a monthly magazine in octavo form. The annual subscription, including postage, is one dollar. The February number contains an article by Prof. A. S. Packard on Lamarck and Neo-Lamarckism, which discusses the actual writings, too often overlooked, of Lamarck himself as well as Prof. Cope's book, "The Factors of Evolution," recently reviewed in our own pages. We wish this interesting and outspoken journal all success in its new shape.

To our French and German Colleagues!

Professor D. T. MacDougal points out in the *Botanical Gazette* for December, that a German botanist has recently duplicated the contribution of an American botanist "in a manner which admits of no extenuation." "His ignorance," says Mr. MacDougal, "may be directly due to the fact that 'the file of the *Botanical Gazette* is not to be found in the Marburg Institute,' but it is a logical outcome of the assumption that the boundaries of botanical science are identical with those of Germany. Our brethren across the water would do well to rid themselves of this erroneous idea, once more nearly true than at present. Their repeated disregard of outside literature will certainly do much to lessen the prestige of the German Institute." We have seen similar complaints elsewhere, indeed, we have ourselves experienced this ignoring habit of our German colleagues. We will not suggest that they might do well to read the pages of Natural Science, but we have certainly been surprised to hear that so indispensable a publication as the *Zoological Record* is hardly known in Germany. The French err in a rather different direction, since they do not seem to care whether their colleagues in other countries read their books or not. It is only thus that we can account for the fact that so few French publishers take the trouble to send us their books for review. A work like "L'Hérédité" of Professor Yves Delage would surely find readers in this country, if only their attention could be drawn to it.

Further Literature Received.

The New Charter, J. C. Kenworthy, &c.: Human. League. The Migration of Birds, F. B. Whitlock: Porter. Untersuchungen über den Bau der Cyanophyceen und Bakterien, A. Fischer: Fischer, Jena. Experimental Morphology, C. B. Davenport: Macmillan, N.Y. Aims and Practice of Teaching, F. Spencer, &c.: Clay. History of Mankind, F. Rätzel pt. 17: Macmillan. Handbook to Order Lepidoptera, vol. iv., W. F. Kirby: Allen. Monogr. Bombycine Moths N. Amer., Pt. I., A. S. Packard: Smithsonian Inst.

Records Aust. Mus., vol. iii., no. i. La Piscifacture Marine, M. Baudouin: Inst. Bibl. Sci. Fortieth Ann. Rep., Sheffield Mus. Catalogue, Dulau. Lieut. Peary's Expedition, G. H. Barton. *Science*. Evidence Former Extension of Glacial Action, G. H. Barton: *Amer. Geologist*. Ann. Rep. Field Columbian Mus. Probable Causes of Decadence of Brit. Rhopalocera, W. Harcourt-Bath, *Entomologist*. Biennial Rep. Biol. Exper. Station; Entomology Illinois River, C. A. Hart New Parasitic Hymenoptera, W. H. Ashmead; Plankton Studies, C. A. Kofoid; New Spp. Rotifera and Protozoa, A. Hempel; N. Amer. Ostracoda, R. W. Sharpe: *Bull. Illinois State Lab.* Bull. Nat. Hist. Soc. New Brunswick, no. xiv. The Chemistry of Some Common Plants, P. Q. Keegan: *Naturalist*. Notes on the Palmer as a Reefing District, R. L. Jack: *Bull. Geol. Surv. Queensland*.

Nature, Feb. 18, 25, March 4, 11, 18; Nature Notes, March; Naturalist, March; Westminster Review, March; Knowledge, March; Photogram, March; Oxford Univ. Jr. Sci. Club Journ., 47, 48, 49 Irish Naturalist, March; Scott. Geogr. Magazine, March; Victorian Naturalist, Jan; Revue Scientifique, Feb. 27, March 6, 13, 20; Feuille des jeunes Naturalistes, March; L'Anthropologie Jan.–Feb.; Naturen, Jan.–Feb.; Naturæ Novitates, Feb.; Literary Digest, Feb. 13, 20 27, March 6; Amer. Journ. Science, March; Science, Feb. 12, 19, 26 March 5; Amer. Geol., March; Botanical Gazette, Feb.; Scientific American, Feb. 13, 20, 27, March 6; The Open Court. Feb.; Chivers' New Book List, March; La Naturaleza (Mexico), 10 & 11; La Naturaleza (Madrid), viii., Nos. 1-8 Amer. Nat., March Review of Reviews, March; Lancet, March 20; Timehri, Dec.

OBITUARY.

CHARLES E. BENDIRE.

BORN HESSE-DARMSTADT, APRIL 27, 1836.
DIED JACKSONVILLE, FLORIDA, FEBRUARY 4, 1897.

MAJOR BENDIRE, the second volume of whose "Life Histories of North American Birds" we have just received, came to America in 1852, and enlisted two years afterwards in the U. S. army. He utilised his service at a number of distant posts in the West, not only for fighting and treating with the Indians to good purpose, nor only in exploring, surveying, and roadmaking, but also in making collections and observations in natural history, many of which were transmitted to Professor Baird at Washington. To Allen, Baird, and Brewer, he wrote important letters, and subsequently appeared as an independent author in his paper on the birds of south-eastern Oregon. His collection of birds' eggs was famous, and he was honorary curator of the department of öology in the U. S. National Museum. He has, however, written on mammals and fishes, as well as on birds. It is greatly to be regretted that his splendid work on North American birds, has been left in an incomplete state.

CONSTANTIN, BARON ETTINGSHAUSEN.

BORN 1826. DIED FEBRUARY 1, 1897.

IN Professor Ettingshausen of Gratz, palæontology has lost one of the older school of enthusiastic workers who helped to found the science of palæobotany. Beginning in 1850, Ettingshausen continued almost to the last the publication of important papers on fossil plants. His best known work is that in which he deals with the venation-characters as a means of distinguishing between various fossil leaves. By the application of the process of nature-printing (*Naturselbstdruck*), which seems to have been first used to any great extent in the imperial printing office of Vienna, Ettingshausen published a very large number of beautifully executed plates of leaf-venation. His two handsome volumes on the *Blattskelette der Dykotyledonen* (1861), and *Die Farnkräuter der Jetzwelt* (1865), are extremely useful aids to the student of fossil leaves. The larger work prepared in conjunction with Pokormy, and entitled *Physiotypia plantarum Austriacarum*, illustrates in a striking manner the possibilities of nature printing. Among the works dealing with descriptive palæobotany those on the Tertiary plants of Austria, England, Australia, and other countries are among the best known. In addition to numerous contributions to Tertiary botany, Ettingshausen has written important memoirs on

Palæozoic and Mesozoic floras, and in most of his papers he gives evidence of a well-marked ability of dealing with his subject on broad scientific lines. Like many of the older school of palæobotanists, he did not concern himself with the internal structure of fossil plants, but the type of work in which he excelled was admirably dealt with in his hands. It is generally admitted that Ettingshausen overrated the taxonomic value of venation-characters; and in many cases the far-reaching conclusions as to the geographical distribution of plants to which he was led cannot be accepted as based on accurate data. Baron Ettingshausen was a genial, quiet, and unassuming enthusiast, and his name will always occupy an honourable position among the earlier scientific workers in the field of fossil plants. He held for many years the post of Professor of Botany and Palæontology in the University of Gratz.

Since our copy of *Science Gossip* for December, 1896, did not reach us till after the middle of January, 1897, we have hitherto been unable to allude to an appreciative note that it contains on the late William Wilson, of Hillocks, Alford, in Aberdeenshire, who died on October 18, at the age of 91. A farmer by profession, "he followed closely all attempts of scientific men to show the relationship of the various sciences to husbandry. As a botanist he discovered *Linneæ* (sic) *borealis* growing on an open moor; Alpine sow-thistle at a lower sea-level than previously known to exist. He was the first to notice what has proved to be a remarkable extension in area of the beech fern (*Phegopteris*). He traced many remarkable changes in the distribution of animals as affected by man's agency, such as the departure of some, and appearance and change of habits of others. Of birds, the snipe has practically disappeared from his district, while the curlew and starling have established themselves during his time."

Thomas Christian Thomassen, who undertook Nansen's duties as curator of the zoological collections in Bergen Museum, while the latter was in Greenland, died at Bergen, on January 13, 1897, at the age of 57. His most important scientific works were on the earthquakes of Norway.

We regret to record the deaths of:—at Winchester, on Nov. 8 last, the botanist F. I. Warner, aged 54; Dr. C. Contejean, of the Pasteur Institute, and Paris Museum of Natural History, at Belgrade on February 24, accidentally self-poisoned; E. Saubinet, President of the Lyons Linnean Society, and an ardent insect-collector; C. F. Wiepken, for 60 years Director of the Oldenburg Museum; A. Rogerhofer, formerly curator of the Imperial Natural History Museum in Vienna; Dr. N. Zdekauer, of St. Petersburg, distinguished for his work to advance hygiene and the knowledge of epidemics; on November 26, in Somaliland, the African explorer A. Cecchi, aged 47, murdered by the natives; on December 13, in Alexandria, the meteorologist A. Pirona, aged 65; on January 1, in Brazil, Dr. Paul Taubert, botanist; Joseph D. Weeks, editor of the *American Manufacturer* and a contributor to the reports of the U.S. Geol. Survey, on December 26, at Pittsburg, Pa.; in Newark, N.Y., the botanist, W. Hayes Ward; Henry L. Whiting, Assistant U.S. Coast and Geodetic Survey and Chairman of the Massachusetts Topographical Survey Commission, on February 4, at West Tisbury, Martha's Vineyard, aged 76.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

THE following appointments are announced:—Professor W. J. Sollas, Trinity College, Dublin, to be Professor of Geology at Oxford; Herbert Smith, New College, Oxford, to be Assistant in the Department of Minerals, British Museum; Isaac H. Burkill, of Cambridge, to be Assistant at Kew Gardens; Miss Umpherston, to be Lecturer in Physiology at St. Andrew's University; Dr. S. Mollier, of Munich, to be Professor of Anatomy at Göttingen; Dr. J. Brandl, of Berlin, to be Professor of Pharmacology in the Munich Veterinary College; Dr. J. Kriechbaumer, to be Curator of the State Zoological Collection, Munich; Dr. E. Beckmann, of Erlangen, to be Professor of Pharmacy at Leipzig; Dr. Carl Fütterer, to be Professor of Mineralogy and Geology at Karlsruhe Technical High School; Dr. C. Nussbaum, to be Professor of Hygiene in the Technical High School at Hanover; Dr. Kirchner, Instructor in Hygiene and Bacteriology in Hanover Technical College, to receive the title of Professor; Dr. K. Kaiser, to be Professor of Physiology at Heidelberg; Dr. F. Lafar, of Stuttgart, to be Professor of Fermentation-physiology and Bacteriology in Vienna Technical High School; A. Engler, of Stans, to be Professor of Forestry at the Polytechnic School, Zurich; Dr. Felix, to be Professor of Anatomy at Zurich; Dr. O. Kruch, of Rome, to the Chair of Botany in the Agricultural Institute in Perugia; E. Chiovenda, to be Curator, and Dr. B. Longo, to be Assistant, at Rome University Botanical Institute; Dr. A. Terracciano, of Naples, to be Assistant at the Botanical Institute, Palermo University; P. Baccarini, to be full Professor of Botany in Catania University; Prof. R. Fusari, of Bologna, to the Chair of Human Anatomy at Modena; Prof. G. Valenti, of Perugia, to the Chair of Human Anatomy at Catania; Dr. Umberto Rossi, of Florence, to be Professor of Anatomy at Perugia; Dr. Kolderup, to be Curator of the minerals and rocks in Bergen Museum; Prof. A. F. von Waldheim, of Warsaw, to be Director of the St. Petersburg Botanical Garden; Dr. L. F. Barker, to be Assistant Professor of Anatomy in the Johns Hopkins University; Prof. Alex. C. Abbott, to be Chief of the Bacteriological Division of the Philadelphia Bureau of Health; R. Rathbun, to be Assistant-Secretary of the Smithsonian Institution, with duties connected with the bureaus of the Institution other than the National Museum; Dr. E. Klebs, to be Professor of Pathology in the Rush Medical College, Chicago.

THE Marquis of Bute, who is now Lord Rector of the University of St. Andrews, intends to erect there a building containing laboratories, lecture-rooms, and museums for the departments of anatomy, physiology, materia medica, and botany, the School to be known henceforward as the "Bute School of Medicine."

THE late Professor W. H. Pancoast has, says *Science*, left his anatomical and surgical collections and $600 per annum to the Medico-chirurgical College of Philadelphia.

SIR ARCHIBALD GEIKIE will deliver six lectures on the principles of geology at the John Hopkins University on Wednesday, April 21, and the five following week-days. He will also give one public lecture in Baltimore. Some geological excursions have been arranged for his auditors.

La Naturaleza (Madrid) for February 18, contains an account of the Institute of Experimental Hygiene of Monte Video, which was inaugurated on March 16, 1896. The director is Dr. José Sanarelli. The stable for animals under observation

contains 60 stalls. The Institute is well furnished with laboratories and with a library, and is lit by electric light. Its object is to investigate various branches of hygiene, chemistry, micro-biology, and sanitary physics. Dr. Sanarelli has already discovered in Rio Janeiro the microbe that produces the amarilla fever, an epidemic which periodically attacks certain districts of Brazil, and this gives the Institute a good start in public estimation.

THE Museums Association meets this year in Oxford, under the presidency of Professor Ray Lankester, from June 29 to July 2. The local secretary is Dr. W. B. Benham. So much excellent museum work has been done of late years at Oxford that an interesting meeting is expected. Those wishing to attend, or to present papers, should communicate with the Secretaries, H. M. Platnauer, The Museum York, or E. Howarth, The Museum, Sheffield.

WE have received the fortieth annual *Report* of the Committee of the Sheffield Museum from September, 1895, to August, 1896. The Museum has now completed the twenty-first year of its existence, and a short summary of its growth is given. Owing to the congestion now arrived at, it is suggested that subsidiary museums should be built in different parts of the town.

A SECTOR of a section of *Sequoia gigantea*, being one-eleventh of the circle, has been presented to the Bradford Corporation by Mr. John Clayton. It is from the same tree as the section shown in the American Museum, New York, and the Natural History Museum, London.

THE *Report* of the Museums at Bolton, Yorkshire, for 1896 states that an exhibit has been arranged illustrating the anatomy, affinities, and life-histories of types of insects, with descriptive labels, drawings, and micro-photographs, as well as specimens. This serves as an introduction to the more extensive collections, and has already proved of considerable use to visitors. The arrangement of the mineralogical and palæontological collections is now completed, the fossils being arranged in stratigraphical order; the labels for the various Periods drawn up by Mr. H. Bolton, and already alluded to by us, have been adopted by this museum. The wall-space is used for the exhibition of photographs, drawings, and maps. On the whole, it appears that those in charge of the natural history collections are fully inspired with the modern spirit, and they have their reward in a steady increase in the number of visitors. We are glad to see that the Bolton Botanical Society holds its meetings in one of the rooms of the museum. The *Report* also contains the meteorological records of Bolton during the year, drawn up by W. W. Midgley.

MR. H. J. ERNST, an apothecary of Iceland, has presented to the State Museum in Stockholm a valuable collection of Icelandic minerals.

THE collections of Gustav Nachtigal from the west coast of Africa, made during 1884–85, are now exhibited in the Berlin Museum of Ethnology.

The Berlin Museum für Naturkunde has received from the island of Ralum a collection of the flora and fauna made by Dr. Dahl.

Science states that a public museum and library will be founded at Cettigne, Montenegro, and that the museum will contain antiquities found in the principality itself, including those recently obtained at Dukla.

THE new building of the South African Museum at Cape Town has now been opened to the public.

FROM the *Report* of the Albany Museum, S. Africa, by the Director, Dr. Schönland, we learn that the monthly average attendance during 1896 was 1,795. Many specimens had been received, but great difficulty was felt in accommodating

the larger Mammalia, owing to insufficiency of room. It is to be hoped that the new buildings will be hurried on by the Cape Government, as it is a poor economy to pinch science. A properly equipped local museum can do enough economic work in one year to save a Government much fruitless expenditure in the matter of insect pests and mineral quests. The chief acquisitions seem to be a large number of types of new plants collected by Dr. Schlechter in the Western Province, Clanwilliam, and Namaqualand.

THE following are the presidents of the British Association for the Toronto meeting:—President, Sir John Evans; mathematics and physics, A. R. Forsyth; chemistry, William Ramsay; geology, G. M. Dawson; zoology, L. C. Miall; economic science and statistics, E. C. K. Gonner; anthropology, Sir William Turner; physiology, Michael Foster; botany, H. M. Ward. Evening lectures will be delivered by Professor James Dewar and Mr. John Milne. Special rates have been obtained from the Canadian railway and steamship lines. The sections will all meet in the buildings of the University of Toronto. It is hoped that, besides British, many foreign men of science will attend the meeting.

A COMMISSION of American botanists has been appointed to consider the establishment and the site of the proposed tropical laboratory. The *Botanical Gazette* states that the assured co-operation of British botanists through a commissioner, and through liberal offers of facilities in case the station is established in British possessions, ensures for the laboratory an international character. A report will be presented by the commission to the meetings of the American and British Associations this year.

C. S. SHERRINGTON, Professor of Physiology in University College, Liverpool, is to deliver the Croonian Lecture of the Royal Society on April 1, taking as his subject "The Spinal Cord and Reflex Action."

THE Royal Zoological Society of Ireland has completed a goat-house and rockery, the latter imitating the natural haunts of the goats and ibexes. A large alligator-pond has been formed in the middle of the aquarium-house, while at one end have been erected heated compartments with plate-glass fronts for tropical snakes and lizards, at the other end cages and a tank for diving birds. The *Irish Naturalist* states that it is intended to erect a new house and paddock for the llamas and camels, two of the latter having died last year in the old house. New quarters for the marsupials are also contemplated.

THERE was once in Great Britain an Aeronautical Society, not to be confused with the Balloon Society. This is being resuscitated, with a committee including Colonel Baden-Powell, Colonel Templar, and Mr. H. S. Maxim. Balloons are now becoming important aids in many kinds of scientific research; thus, on February 18, balloons with observers or self-registering instruments were sent up simultaneously from Berlin, Strasburg, Paris, and St. Petersburg. The Society will have a large field of usefulness.

Science says that Robert H. Lamborn has bequeathed $200,000 to the Academy of Natural Sciences, Philadelphia.

PROFESSOR ANGELO MOSSO of Turin has received from the Reale Istituto Lombardo the Fossati prize of 2,000 lire for his essay on the temperature of the brain.

MR. W. HARCOURT-BATH left England on March 12 upon an entomological expedition to the Himalayas.

The Journal of School Geography for February states that the northern part of Greenland, studied in 1892, by Lieut. R. E. Peary, has been named Peary Land at the suggestion of the Geographical Club of Philadelphia, seconded by many other geographers.

MR. AND MRS. THEODORE BENT, the archæological explorers, have returned from a successful expedition to Socotra.

MR. J. WHITEHEAD has been investigating the highland fauna of the Philippines, where he obtained a huge fruit-pigeon at a height of 6,000 feet.

ACCORDING to Reuter, Mr. Poulett Weatherley, who has just circumnavigated Lake Bangweolo in Central Africa, states that it is smaller than usually marked on maps and that, separated from it by a strip of sand about 400 yds. wide, is a long lake named Chifunanti. These lakes, as well as L. Malombwe on the Upper Shiré River, he regards as recently submerged tracts of lands. They are quite shallow, and Bangweolo has no molluscan fauna.

MR. C. W. ANDREWS, of the Geological Department of the British Museum, has received leave of absence for nine months in order to investigate the natural history of Christmas Id., one of the few spots on this earth that still remains uninfluenced by man.

IT is 400 years since John Cabot, the Venetian navigator, who lived in Bristol, sailed from that city and landed on some coast on the other side of the North Atlantic. The event is to be celebrated both in Bristol and in Halifax, Nova Scotia, on June 24.

WE are glad to note that the salary of the lecturer on fisheries to the Cornwall County Council has been increased to £350 per annum.

THE huge octopus described by Dr. A. E. Verrill in the *American Journal of Science*, as recounted by us in our March number, turns out not to have been a cephalopod after all. Some portions of the integument have been examined by Dr. Verrill, who, writing to *Science*, suggests that it was probably related to the whale, though what part of any cetacean it could have been is still an unsolved puzzle.

A SERIES of lectures on "The Black Death of the Fourteenth Century," was delivered by Mr. W. North, in February, at Willesden Green Public Library. Mr. North traced the origin and progress of the disease, compared it with the present plague in India, and gave some interesting notes on the sanitation of England at the time, and the value of the plague as a sanitary reformer in this country.

C. H. FERNALD, entomologist to the Massachusetts Board of Agriculture, recommends that $200,000 be appropriated for five years in succession, and a smaller appropriation for ten years more, for the extermination of the Gipsy Moth.

MRS. ASA GRAY has been mounting the autograph letters from various botanists received by her late husband. Those preserved number over 1100. The *Botanical Gazette* states that the mounting is now completed, and that, with the letters, whenever possible, an engraving or photograph of the writer has been mounted.

COAL, in seams with a thickness of 16 and 8 feet, has been found seven miles from the northern end of Lake Nyassa.

BORINGS, instituted in consequence of the discovery of coal at Dover, have succeeded in finding coal at Cape Blanc-Nez on the opposite side of the Channel, further west than coal has hitherto been worked in northern France.

CORRESPONDENCE.

Mr. Jackson's Map of Franz Josef Land.

I am obliged to you for the promptness with which you have sent me the March issue of Natural Science, and only regret that you should have thought fit, in the course of editorial comments in two different places in that journal, to repeat and freshly state certain erroneous statements which, in the absence of Mr. Jackson, I am compelled to correct. My reply, however, shall be as brief as possible.

(1) In the first place—to dismiss at once the personal attack on me—I regret that you should not have imitated the invariable practice of editors of reputable journals and accepted, in a purely personal explanation, my emphatic and absolute denial of the motives you imputed to me. I clearly and strongly protested that "nothing was or could be farther from my intention" than to minimise Nansen's magnificent work, and proved this by quoting several extracts from my paper in the *Geographical Journal* (Dec., 1896), which you are good enough to style "effusive laudation." Yet, in spite of this emphatic repudiation, you persist in your attempt to impute to me motives I never so much as dreamed of. Your last sentence in your second editorial comment (Nat. Sci., March, 97, p. 216) runs thus:—"people will infer, most unjustly of course, that he is trying to minimise the results of the Austrian explorer *as well as those of the Norwegian*." (The italics are mine). This statement, I repeat, is capable of but one interpretation—and that one incompatible with acceptance of my word in a purely personal matter.

[We accepted and we accept Mr. Brice's personal explanation absolutely; what we said and still say, is that his way of putting things did actually lead people to read into his remarks motives which they regretted. We repeat, we are glad to find that it was Mr. Brice's style and not his heart that was at fault, and we hope that he will exercise greater care in future.—Ed. Nat. Sci.]

(2) You repeat—and this time with an assurance which is amazing in one who has never been to Franz Josef Land and apparently knows nothing accurate about it—that "C. Mary Harmsworth is identical with C. Lofley." I can only add now that in 1880 Mr. Benjamin Leigh Smith saw the land he called C. Lofley for the first time. He was then *at a distance of forty miles*. ("The farthest point seen, being over forty miles away, was named C. Lofley." *Proc. R. G. S.*, March, 1881, p. 135). In 1881 he saw the cape again, and the land connecting it with C. Ludlow. He was then not nearer than *thirty miles* (see map and track of Mr. B. L. Smith's voyage, *Proc. R.G.S.*, April, 1883). No Arctic explorer would place undoubting reliance on observations at this great distance.

Now Messrs. Jackson and Armitage (with Mr. H. Fisher and others) actually rounded all the capes discovered by Mr. B. L. Smith, and in several instances ascended them and observed from them, *for the first time*. They also observed from a point as far off the land as Mr. Smith was. I naturally prefer their map of the capes in question to one laid down at a range of not less than 30 miles. And so, too, would any sane cartographer.

[We have never doubted the accuracy of Mr. Jackson's maps. Our criticism of the names employed represents the view of people who *have* been to Franz Josef Land; if such a visit be necessary for forming a correct judgment, perhaps Mr. Brice will say when he was in these parts.—Ed. Nat. Sci.]

(3) You return to your assertion that Markham Sound is identical with the British Channel. For after referring to a supposititious position of Markham

Scund, you declare that "this is the exact position usurped by Jackson's British Channel."

My postscript, pointing out that Mr. Jackson was only responsible for names in heavy type in the recently published map (*Geographical Journal*, Dec., 1896), should have saved you from repeating your error.

For *Mr. Jackson is not responsible* for the position of Zichy Land as there indicated in *light type*. He places Zichy Land to the east of the British Channel, but to the west of Markham Sound. (See *Geographical Journal*, Dec., 1895, p. 517)—"The coast of Zichy Land becomes a group of narrow islands, lying roughly north and south between Mr. Jackson's route and Austria Sound." (Also *G. J.*, Dec., 1896, p. 552). And Markham Sound in Payer's map was an arm of Austria Sound.

It is obvious that you have not mastered the elementary fact that the coast of Zichy Land abutting on Markham Sound has become by *actual traversing*—not by looking at it from a distance of at least 40 miles (see Payer's map and track "New Lands within the Arctic Circle" Vol. II.)—a chain of islands to *the east of the British Channel* and between it and Markham Sound. The supposed S.W. prolongation of Markham Sound (see Payer's and Smith's maps) is arrested and occupied by newly discovered islands. Hence the sudden termination of Markham Sound in a S.W. direction. Nansen's and Jackson's maps exhibit this clearly.

[We certainly have not mastered this: for any amount of traversing to transfer a body of land from the west to the east side of a body of water is a geographical feat quite beyond us. It also transcended the powers of the mysterious person responsible for Mr. Brice's previous map; whoever he was we congratulate him on his having placed Zichy Land west of the Elmwood meridian, instead of east of it as Brice, Jackson, and Nansen now do.—Ed. NAT. SCI.]

(4.) As to the land marked 21, and the islands marked 10 and 11, you declare that "these small patches are not quite the same as 'the land to the westward' of Nansen's winter hut, for this obviously included Zichy Land."

I reply that they are the same, and that the land to the westward could not include Zichy Land.

How absurd your statement is may be gathered from Nansen's own map ("Farthest North," Vol. II.) and from his book, with which you have evidently not made yourself acquainted. In his map these lands lie to the west and south-west, while *Zichy Land includes the island on which he wintered*. And this is what he says on p. 398, (Vol. II.).

"At two points on the horizon about W.S.W., I fancied that I could see land looming in the air. The appearance recurred again and again, and at last I was quite certain that it really was land; but it must be very far away; at least 69 miles, I thought." And he adds in a note: "It proved afterwards that the distance was about 56 miles." Now you have only to measure this course and distance on the map, and you have the identical lands to which I referred and no other. They are "quite the same," and Zichy Land could not be "obviously included" in this land to the westward, for the very obvious reason that Nansen was, at the time, actually upon one of the islands which both he and Jackson unite in recognising as Zichy Land!

[Had Mr. Brice written "the small islands to the westward" instead of "the land to the westward" we should, as explained in our last number, have accepted his statement.—Ed. NAT. SCI.]

(5.) But, with even more amazing assurance than this, you reiterate that "Nansen wintered on Payer's Karl Alexander Land." I can only reply that Nansen says that he did *not*; that he definitely maps Karl Alexander Land as *another island* to the N.E.; and that consequently you have no justification for your uncalled-for and offensive remark that Jackson's "gracious permission to rename an already named island has conferred immortality upon the little trip of the Fram."

(6.) As to the rhetoric you expend on the innocent statement that Nansen thought, in his winter quarters, that he was on the west coast of Franz Josef Land—a statement you rashly describe as "incompletely proved"—I merely refer you to the following pages of "Farthest North": Vol. ii., pp. 307, 312, 334, 396, 397, 398, 427, 428, 459—on all of which you will find explicit proof that Nansen believed himself to be somewhere on the west coast of Franz Josef Land. Thus, your challenge

of this simple remark, and, further, your attempt to wrest it into "discredit being cast on Nansen," pass, with the rest of your unfounded criticism, into the thinnest of thin air.

Finally, should you feel moved, in the light of these statements of positive fact—authority for every one of which I give—to reiterate the gross inaccuracies and sinister imputations you have now twice seen fit to publish, I desire to take this opportunity of at once saying that I have neither time nor taste for correcting anonymous critics, and therefore, sir, I beg to bid you farewell.

157 Strand, W.C. ARTHUR MONTEFIORE BRICE.

[Our Review copy of "Farthest North" had not arrived when the March number went to press. At any rate that book was not published when Mr. Brice's paper was issued, and statements which may or may not be proved by it now, were not proved then, and ought never to have been made on the incomplete authority of anyone's private correspondence, quoting casual conversations. This is all the "rhetoric" we expended, and we say again, accepting to the full the good faith of Messrs. Brice and Jackson, such statements should not have been published by the Royal Geographical Society. Fortunately we are now able to deal directly with Nansen, and this we do in our Review on p.268. Consequently we have great pleasure in bidding a sincere "farewell" to Mr. Montefiore Brice.—Ed. NAT. SCI.]

P S.—I submit herewith the map of Franz Josef Land, in which you will see how my statements relative to Zichy Land, Markham Sound, and "the land to the westward" are in every particular confirmed.

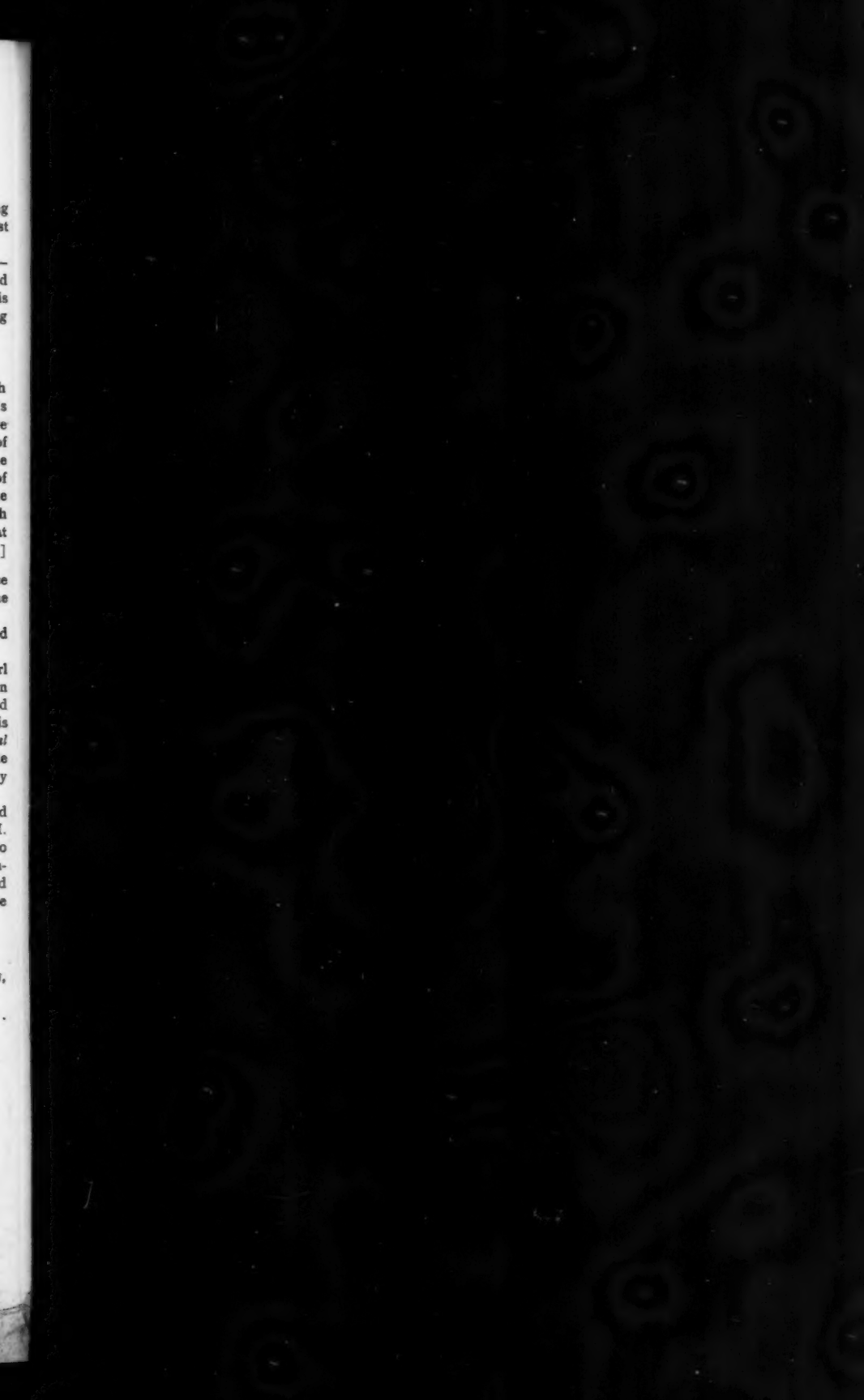
This map also confirms my statements relative to the work of Mr. Jackson and other explorers.

The only point I have not cleared up in this map is your contention that Karl Alexander Land is identical with the land on which Nansen wintered. The reason why I do not is—first, that Nansen has himself abundantly proved in his map and book that he did *not* winter on Karl Alexander Land; and, secondly, because in this composite map—which is practically identical with the one in the *Geographical Journal*, on which you based your criticism—no attempt has been made to reconcile at the points of contact Payer's map with Jackson's, or, indeed, to interfere in any way with Payer's map where it does not touch Jackson's work. A. M. B.

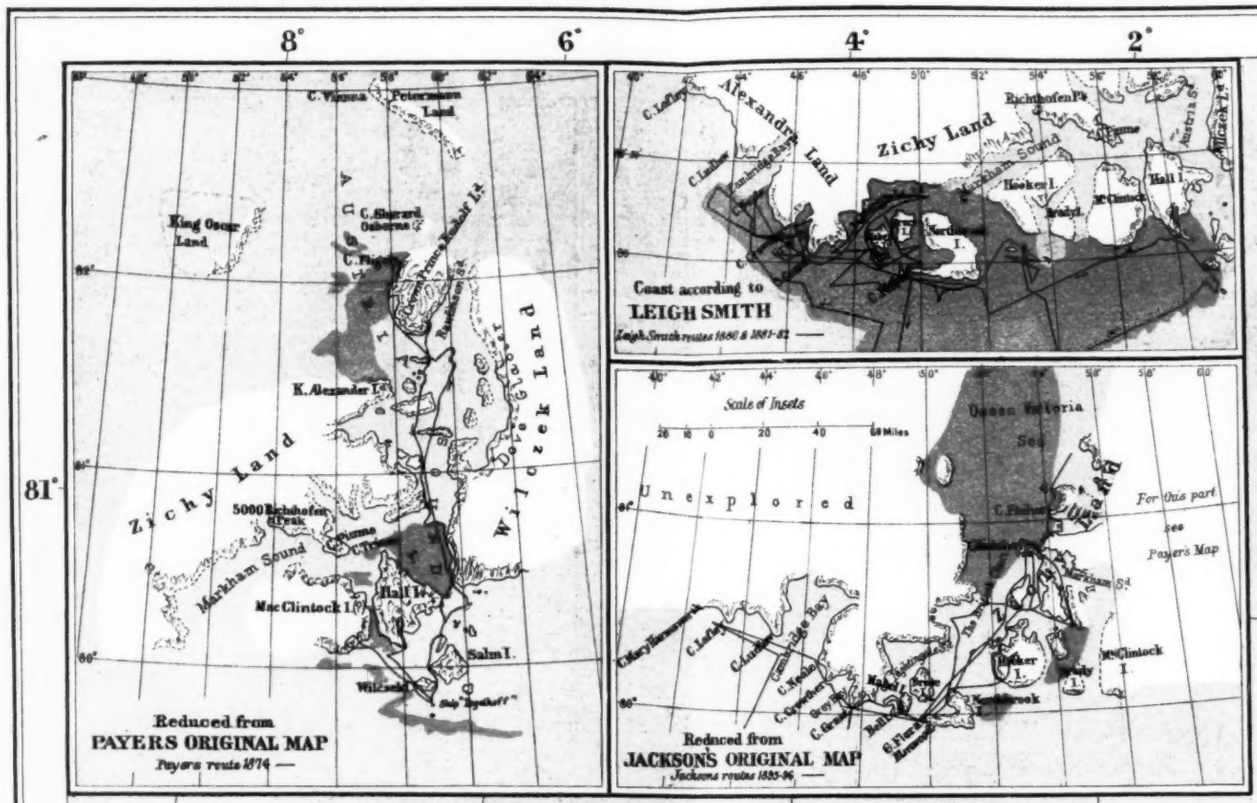
[We are in no way responsible for the names or statements on this map. Had we made any addition to it, it would have been the explanation, prefixed by Mr. H. Fisher to his "Remarks on the Flora of Franz Joseph Archipelago" appended to Mr. Brice's oft-quoted paper: the explanation runs, "In this case I have not considered priority in names of importance." We need only add that we are indebted to Mr. Brice for bearing most of the expense of this map, a courtesy for which we trust he will accept our thanks.—Ed. NAT. SCI.]

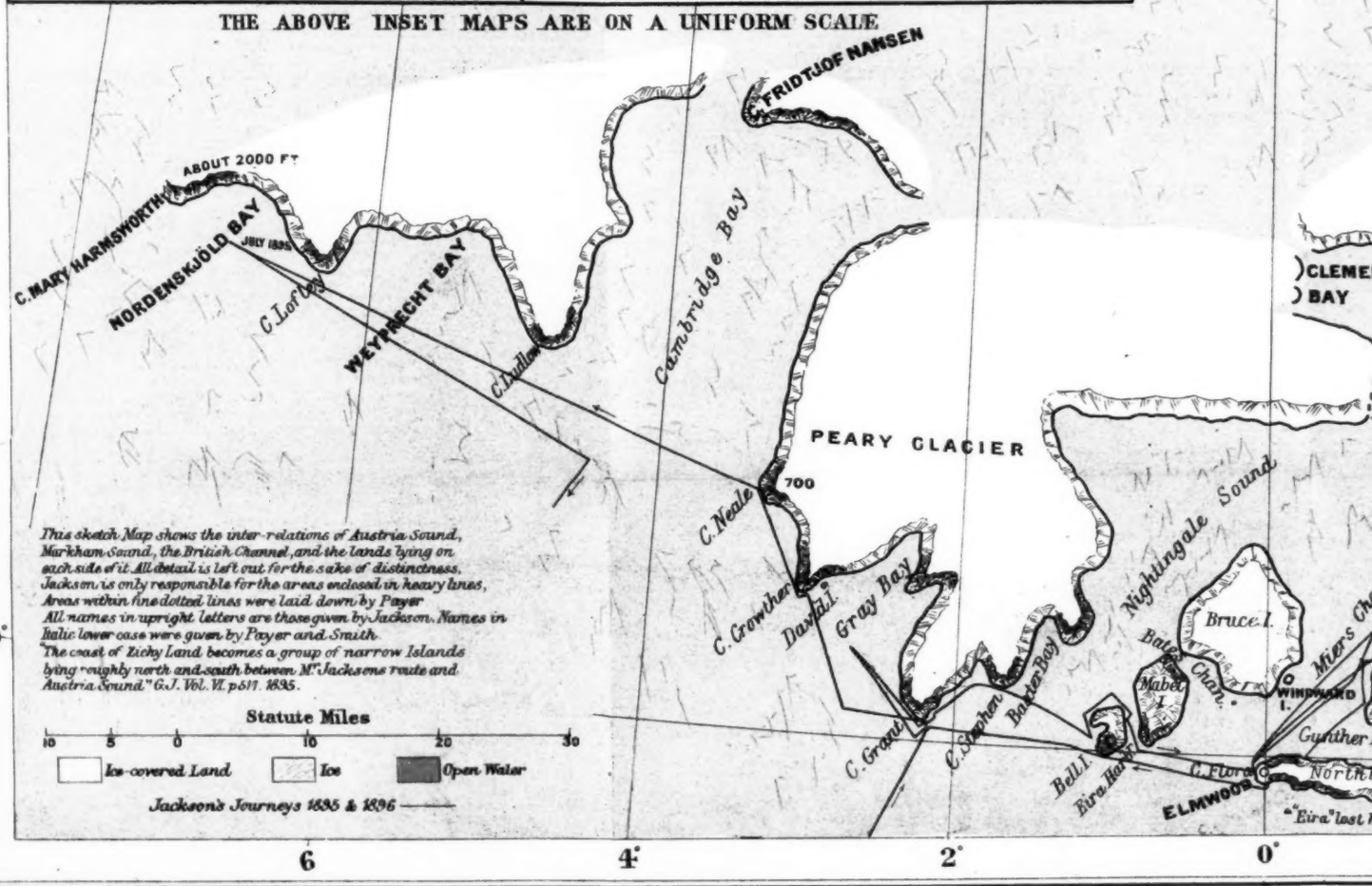
WE regret that communications from Messrs. BROOKS, COCKERELL, COLLINSON, GOODRICH, and KEEGAN should be crowded out of our Correspondence.

Our usual NOTICE will be found on page iii. of wrapper.



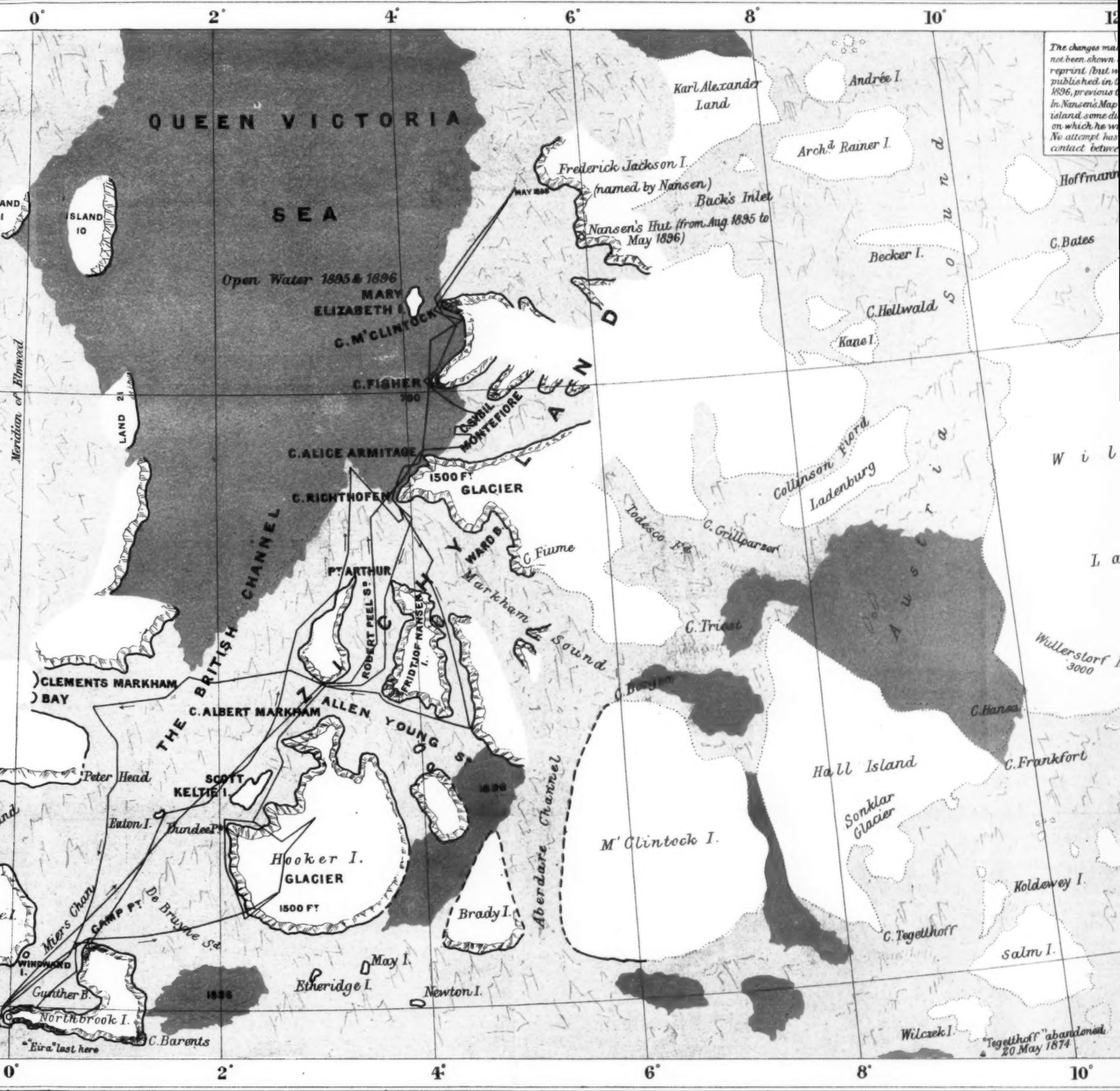
SKETCH MAP OF FRANZ JOSEF LAND SHOWING JOURNEYS & DISCOVERIES




FRIDTJOF NANSEN
ABOUT 2000 FT
C. MARY HARMSWORTH
NORDENSKJOLD BAY
JULY 1895
C. Ioa
WEYPRECHT BAY
C. Dudley
Cambridge Bay
PEARY GLACIER
700
C. Neale
C. Crowther
Dawkins
Gray Bay
Nightingale Sound
Bruce I.
Mabel I.
C. Grant
C. Stephan
Baxter Bay
Bell I.
Eira Harbour
ELMWOOD
Meridian of Elmwood
This sketch Map shows the inter-relations of Austria Sound, Markham Sound, the British Channel, and the lands lying on each side of it. All detail is left out for the sake of distinctness. Jackson is only responsible for the areas enclosed in heavy lines. Areas within fine dotted lines were laid down by Payer. All names in upright letters are those given by Jackson. Names in Italic lower case were given by Payer and Smith.
"The coast of Zichy Land becomes a group of narrow Islands lying roughly north and south between M.r Jacksons route and Austria Sound." G.J. Vol. VI. p511. 1895.
Statute Miles
Ice-covered Land
Ice
Open Water
Jackson's Journeys 1895 & 1896 ——

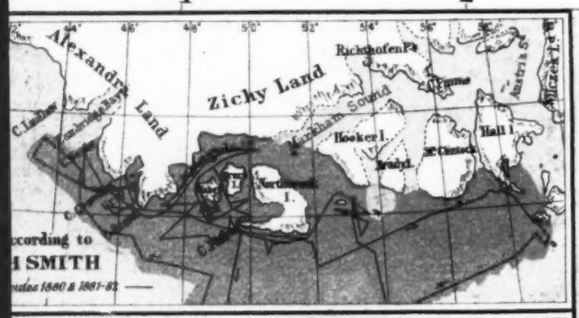
Elmwood lies in 49° 47' 15" East Lon

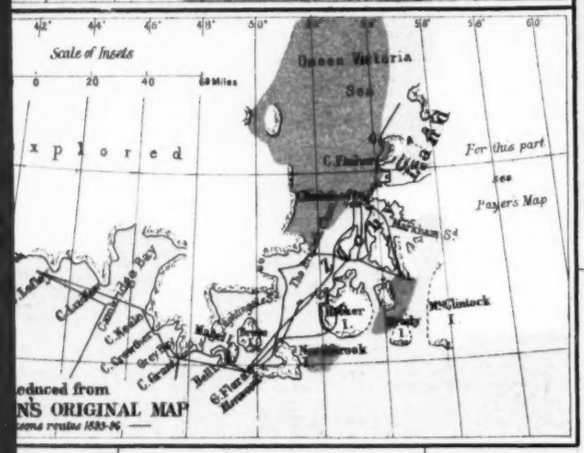
COVERIES OF FREDERICK JACKSON F.R.G.S. LEADER OF THE JACKSON-HARMSWORTH POLAR EX



49° 47' 15" East Longitude

OSEF LAND SHOWING JOURNEYS & DISCOVERIES OF FREDERICK JACKSON F.R.G.S LEADI





ON A UNIFORM SCALE

QUEEN VICTORIA SEA

Open Water 1895 & 1896

ISLAND 11

ISLAND 10

LAND 21

Meridian of Elmwood

MARY ELIZABETH I.

C. M'CLINTOCK

C. FISHER 700

C. SIBIL MONTEFIORE

C. ALICE ARMITAGE

1500 FT GLACIER

C. RICHTHOFEN

MAY 1895

FRIDTJOF NANSEN

Cambridge Bay

PEARY GLACIER

C. Neale 700

C. Crowther

Daffil

Gray Bay

C. Grant

C. Stephen

Baxter Bay

Nightingale Sound

Bruce I.

Bell I.

Eira Harbour

C. Flora

ELMWOOD

"Eira" last here

Peter Head

Eaton I.

Dundee Pt

Mabel I.

Boulton Chan.

Miers Chan.

WINDWARD I.

Gunther B.

Northbrook I.

C. Barents

CAMP Pt

De Bruyne Sd

Hooker I.

GLACIER

1500 FT

1896

Etheridge I.

May I.

Newton I.

Brady I.

Aberdare Channel

THE BRITISH CHANNEL

CLEMENTS MARKHAM BAY

C. ALBERT MARKHAM

Pt ARTHUR

ROBERT PEEL Sd

FRIDTJOF NANSEN I.

ALLEN YOUNG Sd

WARD B

Markham Sd

C. Fium

SCOTT KELTIE I.

1896

4° 2° 0° 2° 4°

Elmwood lies in 49° 47' 15" East Longitude

G.S LEADER OF THE JACKSON-HARMSWORTH POLAR EXPEDITION.

George Philip & Son, 32, Fleet St. London.